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THE PRACTICAL TEACHER

Yours faithfully John Kerr

(See article "Memories.")

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THE

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A MONTHLY MAGAZINE AND REVIEW

FOR THE SCHOOL-ROOM AND THE STUDY

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EDUCATION IN PARLIAMENT.—AFTER EASTER.

THE debate at Portsmouth, at the end of which the Conference of the National Union of Teachers so unmistakably affirmed the desirability of standing by the Cowper-Temple clause in Provided Schools, had a repercussion in Parliament. Before Easter there was much talk and many rumours about a fresh compromise—the Voluntary Schools to be handed over wholly to public management in return for the right of clerical and ministerial persons to enter them and the Provided Schools also, for the amiable purpose of giving "direct doctrinal instruction." Since Easter the idea has drooped, and it is a flower which no watering, no matter how assiduous, is likely to revive. The directing influence of the teachers' opinion is manifest in this.

But there has been one notable suggestion of compromise, though upon another part of the great and difficult subject of education in South Britain. On April 20, Sir William Anson, while taking his rod out of pickle and showing it to the listening members for Wales, put in a quietly eloquent little plea for a compromise instead. "Be good boys, you Taffies," he said in effect, "and I will gladly drop what you call a Coercion Bill." But his words, though generously cheered, found little echo, and the Educational (Local Authority Default) Bill is to go on.

Weeks earlier than that the Bishop of St. Asaph was to have presented *his* little Bill for settlement—settlement of the strife in Wales. But the bishop's draft Bill contained a clause which would give that very "right of entry" which the Portsmouth Conference had almost unanimously scouted, and the Bill did not see the light. After Sir William Anson had brandished the rod in pickle for the Welsh education authorities there was a pause—a prolonged pause—and the idea was that during this lull the bishop was to move a new version of his Bill as an olive branch. Well, the bishop's Bill is now extant, and it contains the obnoxious clause. Sir William Anson's Bill is not yet "through the wood."

"It is all the country parsons," the Welsh M.P.'s declare. "The Bishop of St. Asaph is a sensible man, and we were ready to accept his compromise a year ago. But the country parsons in his diocese wouldn't let him offer it; it was they who applied the pastoral crook, to the leg of what they considered a wandering sheep." So, after infinite cogitation, the Local Authorities Default Bill was put into words. It is brief enough to quote, and its meaning needs no gloss or commentary for readers of *The Practical Teacher*:—

"1. (1.) The Board of Education, without prejudice to their right to take any other proceedings, may, if they are satisfied that it is expedient to do so on account of any default of a Local Authority in the performance of their duties as respects any elementary school—

"(*a*) make orders for recognising as managers of that school any persons who are acting as managers thereof, and for rendering valid any act, thing, payment, or grant which in the opinion of the Board might otherwise be invalid by reason of the default of the authority, and every such order shall have effect accordingly; and

"(*b*) if it appears to the Board that the managers of that school have, for the purpose of maintaining and keeping efficient the school, incurred any expenses for which provision should have been made by the Local Education Authority, pay to the managers such amount in respect of these expenses as in the opinion of the Board was properly incurred.

"(2.) Any sums paid by the Board of Education under this Act shall be a debt due to the Crown from the Local Education Authority, and, without prejudice to any other remedy, may be deducted from any sums payable to that authority on account of parliamentary grants.

"(3.) Any order or payment may be made under this Act as respects matters occurring whether before or after the passing thereof.

"2. This Act shall be construed as one with the Education Act, 1902, and may be cited as the Education (Local Authority Default) Act, 1904."

The Cinderella of the United Kingdom has had "a night out," a week earlier than the Welsh episode, a fort-

night earlier than the Second Reading of the Scottish Education Bill, and some two years later than the English Education Bill of 1902. It was certainly Ireland's turn. There is a parliamentary process currently known as "getting the Speaker out of the chair," and it was a newly-arrived M.P. from Ireland who made the traditional mistake about that some years ago. He overheard some members of the Ministry talking solemnly together, and caught the words, "We *must* get the Speaker out of the chair to-night." He was horrified. Here was conspiracy! And as at the moment the Irish party were supporting the Opposition "agin the Government," he thought it his duty to reveal to the Opposition whips what he had discovered anent the dark design.

As each class of estimates for the public service comes on initially, the Speaker states to the House, "The question is that I do leave the chair." If nobody were to rise to speak, he would put the question and leave the chair, the business then proceeding under a Chairman in Committee. But somebody always does rise, says "Mr. Speaker," and begins to dilate upon some subject connected with the class of estimates just then before the House. So Mr. Speaker settles himself back in his chair patiently, and a desultory debate goes on.

On April 18, Mr. Nannetti, a worthy compositor from Dublin, though the possessor of an Italian name, caught the Speaker's eye, and began to talk about education in Ireland. He moved "That, in the opinion of this House, the system of primary education in Ireland is fundamentally defective, and has proved injurious in its operation." He said that if he were asked how the system was to be reformed, his answer must be, "By changing it from top to bottom." The Board of Education was non-elective and anti-national; the schools were uncomfortable, unhealthy, and unattractive. In short, Ichabod was the word.

With greater knowledge of the subject, and quite a charming style of speaking, the teacher-member among the Irish (who boast an ex-school inspector also), Mr. Thomas O'Donnell, contended that during the past seventy years no real progress had been made in education in Ireland. He claimed for it a root-and-branch change—decentralisation, local government, and the other features which characterise public education in Great Britain. At present the poorest classes of people in Ireland were in a greater state of ignorance than similar classes in any other country of Europe, he said.

Mr. Wyndham, as Chief Secretary to the Lord-Lieutenant of Ireland, was sympathetic but pessimistic in his reply. Sir John Gorst, Mr. Redmond, and Mr. T. W. Russell had backed up the motion, but Mr. Wyndham could not the less think it unreal. How unreal must be a claim for elected School Boards or Education Committees in Ireland came home to nearly everybody who listened. At present, in their respective school freeholds, the priest, parson, and presbyter are lords and masters. Will they yield up this autocracy? And are the devout, subservient Irish the people to make them, if they won't? Alas for "the most disthressful country!" The "religious difficulty" in England is as nothing compared with what it is over there. In Ireland most of all "the theologian blocks the way."

Dr. Macnamara soundly rated the Chief Secretary for his pessimism, and also for mentioning the monetary difficulty; and presently the debate closed. Its chief significance lies in the fact that it is almost the first Irish demand heard in Parliament for local self-government *in education*. But it was very much a piece of parade.

The Second Reading of the Scottish Education Bill was a very different affair: not much parade, but a good deal of utter earnest. It took place on the very day when the London School Board died and the London County Council took over its property and functions. Representatives of the Educational Institute of Scotland had been busy for days in inculcating the views of the Institute in the ears of Scottish M.P.'s. In "gude Scotch" the members talked about the Bill. Mr. Black wanted to preserve and group existing School Board areas, but did not put his proposal to the vote. Mr. Bryce was epigrammatic on the contrast between an English education debate and a Scotch one. The English M.P.'s, with the exception of Messrs. Gray, Macnamara, and Yoxall, almost all kept aloof. One of them said, "I don't understand the language."

Writing in the *Nineteenth Century and After* for May, Mr. Walter Frewen Lord remarks: "Slowly—yet not very slowly for Englishmen—the great industrial centres of the country are realising what the Scots have realised for several centuries—namely, that the best-educated nation wins. There is nothing magical about the success in life of Scotsmen; their pre-eminence is not in consequence of their poverty, although perhaps to a certain extent of their religion. We never hear Scotsmen imbecilely dogmatising as to the utility of that or the futility of this branch of learning. They know well enough that a strong, flexible intelligence, however acquired, is a valuable asset in the battle of life. They cherish and respect the intellectual process; Englishmen despise it."

But let us not be too sure that these remarks are still true of England; at any rate, they will soon cease to be true. One result from Education in Parliament during the last few years—it has been contemporaneous with the presence of ex-teachers in Parliament—is that the face and base of things educational in England have been changed. A few years hence and (it is not too much to expect) we are likely to see England equipped educationally to an extent seldom rivalled and little surpassed elsewhere. There is the liveliest prospect of promise in English education. Once John Bull-dog gets his teeth into a thing he holds.

But Scotland need not stand still—it need not stand where it did in education. How wisely and carefully this Bill has been prepared, let an extract from the purposes stated for the School Fund and its use by

Next Month:
ILLUSTRATED HOLIDAY NOTES.

School Boards testify. The Boards may apply the Fund—

"In providing, under their own direction or through managers, any form of education or instruction which may from time to time be sanctioned by any code or minute of the Department, and in providing for the physical training and recreation of the pupils attending schools within their education district, and for their medical supervision:

"In paying, either separately or in combination with other School Boards, the salaries of visiting teachers giving instruction in several schools in turn, or of superintendents and organisers of technical or other special forms of education:

"In granting pecuniary aid upon such conditions as they may from time to time prescribe to schools and institutions not under their charge, where such schools or institutions are recognised by the Department as supplying efficient education:

"In establishing bursaries of such amount as they may fix from time to time, to be open to pupils attending schools within their district, whether such schools are under their charge or not, and to be tenable at schools or institutions recognised in terms of this Act as supplying efficient higher education, or at a university:

"In bringing opportunities for education within easier reach of children in outlying parts of their district, whether by providing vehicles, paying travelling expenses for teachers or children, or otherwise, whenever the School Board shall consider such special provision or expenditure required by the circumstances of their district or of any part thereof:

"In paying pensions or retiring allowances to teachers in their employment who were certificated teachers before the commencement of the Elementary School Teachers (Superannuation) Act, 1898, irrespective of whether such teachers have accepted the said Act or not, and anything in the said Act to the contrary notwithstanding."

And now the word lies with Wales. Is Wales to stand still—in fact, recede—in elementary education for a year or two, or more, because Nonconformity has a quarrel with Episcopalianism? Is education still to be the shuttlecock between theological battledores, in a land where intellects are so keen and a love of study so general? "It is all the country parsons," say the Welsh M.P.'s. "It is all the wicked dissenters," say the country parsons. "It is all stuff and nonsense what you say, the pair of you," says the educationist pure and simple.

BY MANY HANDS.

"Quot homines, tot sententiæ."

N.U.T. NOTES.

THE M.B.T.A., inferior numerically to the N.U.T. and N.F.A.T. alone among professional organisations, has ceased to exist as such. On May 1 it became the "London Teachers' Association," having thrown open its doors to all certificated or registered teachers and instructors working in schools or colleges which, according to the provisions of the London Education Act, 1903, came under the administration of the London Education Authority. This wise step, taken unanimously by what I have seen described as the largest meeting ever held under the auspices of the M.B.T.A., will go far in the direction of concentrating the energies of the London teachers on all educational and professional reforms. By an overwhelming majority, the same meeting declined to take a further step which would in my opinion—of course I write as an outsider—have done perhaps more to consolidate the teaching forces of the metropolis than anything else. The decision of the M.B.T.A. to take no present part in the formation of a London County Association is as strange as it is regrettable. It will be remembered that the 1902 Education Act led to the disbanding of the various district unions, and the setting up in their stead of county associations, and forty-four of these were in existence at the end of last year. Before the London Education Bill was even passed the Executive were requested by practically all the associations in the metropolitan area to take immediate steps for the formation of a London County Association, which should be in effective working order on "the appointed day." Representatives from the metropolitan associations were accordingly invited to a conference at Russell Square, and after a particularly full and exciting debate it was agreed that a county association should be formed, and that the M.B.T.A. be cordially invited to co-operate in the matter. On various occasions members of the Executive met gentlemen representing the M.B.T.A., and it looked as if terms acceptable to both organisations would be agreed to. The M.B.T.A. Committee, however, recommended—"That, in the opinion of this association, the present time is inopportune to amalgamate the M.B.T.A. with the N.U.T. The association hopes that the *status quo* will be maintained, and that the same friendly relations existing between the N.U.T. and the M.B.T.A. will be continued;" and it was so resolved, an amendment by Messrs. Jackman and Hole being largely lost. Looking carefully through the *London Teacher's* report of the debate, I conclude that the committee owes much to the magic and deservedly-respected name of Mr. Gautrey. Meanwhile, may every possible success attend the L.T.A.!

The London Teachers' Association.

IF I were asked to state what, in my opinion, was the most astonishing educational feature of the past decade, I should reply unhesitatingly, "*The growing appreciation of the certificated class teacher.*" I recollect very well the time when his position in the school was of the humblest, when his tenure of office was most precarious (depending as it did not only on the reports of the head teacher, but on the whims and vagaries of all sorts of outsiders), and when his remuneration was of the scantiest. Thanks, however, to the increased demand for the services of adult qualified teachers by the leading School Boards, and thanks still more perhaps to their having learned the value of combination, the class teachers' salary scales have gone up by leaps and bounds, until £200 per annum already figures in the salary scale of certain enlightened educational authorities. But in the general advance towards prosperity the class teachers under the (late) London School Board have not by any means shared. When I left college in the early eighties, the service of the London School Board was looked upon, and rightly so, as the "plum" of the teaching profession. Where is it now? Relegated to a very lowly position, with the result that never before was there such an outcry in the London schools for more assistant teachers. I am not at all certain that the metropolitan class teachers have been sufficiently strenuous in working out their own salvation, and I have heard it freely

At Essex Hall.

stated that the money earned in the night schools has been the curse of the situation. Be this as it may, it was with unfeigned satisfaction that I witnessed a very fine gathering of enthusiastic and earnest class teachers in Essex Hall, on a particularly inclement night a month ago.

ONE never wearies of drawing attention to the work done by the Benevolent and Orphan Fund of the National Union of Teachers. The Union itself is often freely criticised on account of its educational policy (or lack of policy), and its tendency towards trades-unionism; but its efforts on behalf of the widows and orphans, the suffering and distressed, invariably commend themselves to all who hear of them. The following interesting table shows how the various electoral districts assisted in the beneficent work during the past year :—

The "B and O" Council.

District.	Title of District.	Contributions.	Averages.		
			1901.	1902.	1903.
		£ s. d.	s. d.	s. d.	s. d.
1	North England	754 4 4	4 3	13 6	4 10
2	Lancashire . .	2,422 18 5	5 3	6 1	8 0
3	Yorkshire . .	1,094 13 1½	4 4	9 1	4 1
4	North Midland	3,231 6 3	4 5	12 6	16 5
5	South Midland	1,177 2 3½	5 4	5 7	5 3
6	East Anglia .	592 8 2½	8 1	3 10	3 4
7	South England	2,443 16 3½	4 8	4 8	10 11
8	West England	737 15 0½	6 5	6 3	4 0
9	Wales . . .	874 2 2	3 2	5 1	4 8
10	North London	722 19 4	3 7	3 8	4 0
11	East London .	1,104 6 0	4 8	5 2	5 0
12	South London	941 8 3	4 7	5 0	4 7
	Totals . .	16,096 19 8½	4 11	6 7	6 4

The new council began well by electing as its chairman Mr. T. G. West, who had won his spurs years ago in connection with the Fund's Organisation Committee. The vice-chair fell to Mr. W. Brenchley, a London teacher whose labours for twenty years fully entitled him to the honourable distinction. The chief standing committees of the Fund are (*a*) Organisation, (*b*) Finance and General Purposes, (*c*) Relief and Loans; and these chose as their officers for the year (*a*) Messrs. F. F. Wheeler and P. Thomas, (*b*) Messrs. C. W. Hole and A. Tutt, (*c*) Messrs. T. R. Rand and H. Hone, respectively.

THE Standing Committees of the Executive are grouped in the following pairs, and meet concurrently :—(1) Law (or Tenure) Committee and Education Committee; (2) Organisation Committee, and Finance, Press, and General Purposes Committee; (3) Parliamentary and Superannuation Committee and Examinations Board. No member of the Executive can serve on more than three of the Standing Committees, or on more than one committee in each pair. The officers of the committees were chosen as subjoined :—

The Standing Committees.

No.	Committee.	Chairman.	Vice-Chairman.
1	Law . . .	Mr. Hurden.	Mr. Prosser.
2	Tenure . .	*Mr. Sykes.	*Mr. Hyden.
3	Education .	*Mr. Pickles.	*Miss Cleghorn.
4	Organisation .	*Mr. Rankilor.	*Mr. Caudle.
5	Finance . .	Mr. Blackburn.	Mr. Boulter.
6	Parliamentary .	*Mr. Jackman.	*Mr. Cullum.
7	Examinations .	*Mr. Bowers.	Mr. Crook.

Those marked (*) held the same positions last year. Messrs. Hurden and Blackburn come up from the vice-chairs of their respective committees, and have well earned their promotion.

A. C.

NOTES FROM THE NORTH.

THE second reading of the Scottish Education Bill was received with nearly as great a chorus of praise as that which was accorded on the first reading. In some respects there was greater attention to detail, greater concentration on what are to many the defects of the Bill, but on the whole there was little disposition on the part of the House of Commons to criticise adversely the main features. So that now, whatever of opposition is to be met with will be given in the Committee stage. The Secretary for Scotland, on those points to which exception has been taken by the teachers, said he had an open mind; but if I may be allowed to read between the lines, I should be inclined to say that the teachers are more than likely to carry their improvements. It is evident that a compromise will in many cases require to be resorted to with regard to the area. In not a few cases the county area is too large; but it is equally true that the district area, that selected by the Bill, is too small. In all likelihood, therefore, the county will be chosen as the area in considerably more instances than the eight counties at first arranged for.

The Second Reading.

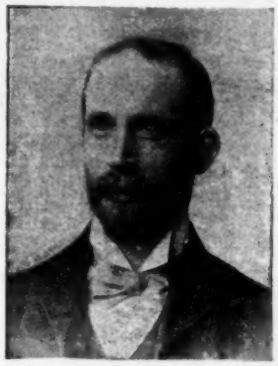
THE duties of the four provincial councils, and the details of their composition, have not yet been clearly set forth. I am very strongly in favour of one national council—a council sufficiently representative of educational opinion to make its influence felt. To it I would entrust the training of teachers. It is generally admitted that the day of denominational training colleges is past. They did, and are still doing, excellent work, no doubt, but it is in the highest interests of the profession that the training should now be undertaken by the university. This training should be the work of the national council, or, if the Government still adhere to their present intentions, the provincial councils. If they did no other work than this, their existence would be amply justified. One other important duty that might devolve on this council is the drawing up of the Code. By some it is considered that the present inelastic and cast-iron Code should give place to one consisting of a "series of options." The necessity for co-ordinating all grades of education is so urgent that it is desirable that there should be this series of options. The Scotch Education Department will, of course, stay in London.

Provincial Councils.

IT is officially announced that whenever the present Bill becomes law the present Secretary for Education, Sir Henry Craik, will resign. In all points teachers have not seen eye to eye with Sir Henry Craik in the most recent movements of the Department; nevertheless every one will admit that during his tenure of that important office he has done much to better Scottish education. The great and marked progress made in education in Scotland during the last ten or twenty years has been in large measure due to the remarkable energy, foresight, and skill with which he has guided the ship. His loss to education will be deeply regretted, and it is the ardent wish both of teachers and educationists that he may be long spared to enjoy his well-earned rest. Mr. John Struthers is mentioned in not a few quarters as his successor. Many of us know the work he has already done, and if his present and past work are any earnest of the future,

Changes in the Scotch Education Department.

we look with confidence to the new dispensation. The beginning of a new order is always trying, but we have every reason to believe that Mr. Struthers will be equal to the emergency. Mr. George M'Donald is marked out by some as the person most likely to fill the new post of Secretary in Scotland, if such a position is to be created.



Mr. Robert Dickson, M.A.

* * *

E.I.S. Doings.

THERE is nothing in the air just now but discussions on the Bill. Every branch is at present adding its quota of wisdom to the general total. But still there are signs of some interest being taken in the elections for the presidentship and General Committee of Management. I have omitted the vice-presidentship, as, for the first time since the new regulations came into force, there is to be no vote for the second honour. Mr. Robert Dickson, M.A., Edinburgh, has, through the withdrawal of the other candidates, been elected to that office without a vote. He is the second class teacher who has reached that position. I hear with much regret that Miss Fish, Glasgow, has withdrawn her candidature for the General Committee in the Clyde Province. As Convener of the Ladies' Committee during the last year she has done admirable work. It is to be hoped that she will yet see her way to return to the committee, and to give the Institute the benefit of her valuable services. R. G.

THE NEW CODE.

IN taking up a new novel or a new Code our general plan has been to begin at the end of the book. In the case of a novel the purpose is known to most people, and in the case of a Code we were always most anxious to see the changes introduced, and these were always very clearly set out in the list of "new and modified articles" printed at the end. The newest Code contains no such list of modified articles, for the whole Code has been recast. Perhaps other Codes have introduced greater principles or more numerous details, but we cannot recollect seeing so great a change of form in a Code before. Very gratifying also are the changes of spirit to be observed in this production. The Education Acts of 1902 and 1903 have introduced changes which have necessitated other changes in their turn. The tendency is to decentralise and give as much responsibility as possible to the local authorities; hence the new Code shows a desire to enable the various local authorities to carry out the educational reforms and meet the requirements of their respective localities. The Acts having set up the local authorities, the Code manifests an unmistakable desire to trust them; and that spirit of confidence in the teachers which has been the characteristic of the procedure of the present permanent secretary and of his predecessor is plainly exhibited in the present issue. In fact, the preface admits that further changes will have to be made to meet the new educational conditions, and concludes by saying that "the Board will at all times welcome suggestions for such changes, whether from members and officers of local authorities, or from the teachers, upon whom, after all, whatever be the form of the regulations, must depend the efficiency and the good influence of the schools."

The newest Code opens with a preiatory memorandum setting out the hope that the endeavours which have been made to simplify the arrangement and phraseology will lead to its being read and understood, not merely by teachers and managers, but by the general public, and especially by the parents of children attending, or likely to attend, the public elementary schools.

The regulations for the training and instruction of pupil teachers and of students in training colleges have been published separately; hence the present Code deals with public elementary schools alone.

The "Revised Instructions" are now withdrawn, but a companion volume to the Code is promised which shall contain suggestions for the guidance of those who are concerned with the educational as distinct from the administrative side of school work. It will deal with the educational principles and methods which underlie the regulations contained in the Code. A new method of paying grants is proposed, which, however, will not come into operation before August 1, 1905, but in all other respects the Code will come into operation on August 1, 1904.

Following the preface, and preceding the detailed chapters of the Code, is an "Introduction," which we should like to give *in extenso*. It may be described as the profession of faith of the Board of Education. It sets out in clear terms the purpose of the public elementary school and the best means to enable it to serve its purpose, and we feel, as the Board evidently feels, that the vast majority of teachers will not only assent to that profession, but will endeavour to act up to it.

The first chapter states that the scheme of instruction should comprise :—

1. *The English Language*, including speaking with correct pronunciation, reading aloud with intelligence and clear enunciation, writing, composition, and grammar. At each stage recitation of pieces of literary merit should be practised.

2. *Arithmetic*, including practice in oral and written description of the processes used.

3. *Knowledge of the common phenomena of the external world*, with special reference to the formation of a habit of intelligent and accurate observation, and to the application of that habit—in conjunction with simple forms of experiment—in the daily life of the scholars.

4. *Geography*, advancing from first notions to an outline knowledge of the chief physical features of the earth, and especially of the British Isles and the British dominions beyond the seas. This paragraph reads as though only the physical features of the British Empire are to be studied, but we should think that political, social, and industrial facts are intended as well.

5. *History*, comprising a general knowledge of the great persons and events in English history, and of the growth of the British Empire.

6. *Drawing*, including drawing from actual objects, memory drawing, and brush drawing, together with other simple hand and eye training.

7. *Singing*, which should, as a rule, be taught by note, and should include practice in proper breathing.

8. *Physical Exercises*, according to an approved system.

9. *Plain Needlework*, for girls, including in the later years lessons in cutting out.

This instruction must be according to a syllabus which the inspector may require to be submitted to him at any time. The time-table must not only be approved by the inspector, but must be open at any reasonable time, except the ordinary school hours, to the inspection of the parent of any scholar attending the school who makes a written application to see it.

The chapter dealing with the question of staff gives a minimum of staff that will be considered sufficient for the number of children in average attendance—namely, the head teacher for 50; a certificated assistant for 60; an uncertificated assistant for 45; a supplementary teacher (formerly called Art. 68), a provisional assistant teacher, or a pupil teacher, for 30; and a probationer for 20. The grant, moreover, may be withheld if the number of scholars habitually present under the instruction of any teacher exceeds by more than 15 per cent. the number for which such teacher is equivalent. Written agreements are insisted on, and these must contain the "extraneous duties" clause. The term "assistant teacher" loses the connotation it has had in former Codes, and Article 68's become "supplementary teachers." After July 31, 1905, not more than one supplementary teacher as a rule, and in no case more than two, will be recognised as part of the staff of any department. The Board also *may* require that suitable arrangements be made for her to receive special instruction.

A great change is made in the arrangements for paying grants. In order to encourage such teaching as will induce parents to keep their children at school as long as possible, the attendance grant will depend on the age of the pupils: 15s. a head will be paid on children between three and five years of age, 20s. on those between five and twelve, and 25s. on those between twelve and fifteen, above which age education is not considered "elementary." Additional grants are made for special subjects, and the educational year for a special subject may be independent of that for other subjects or for finance.

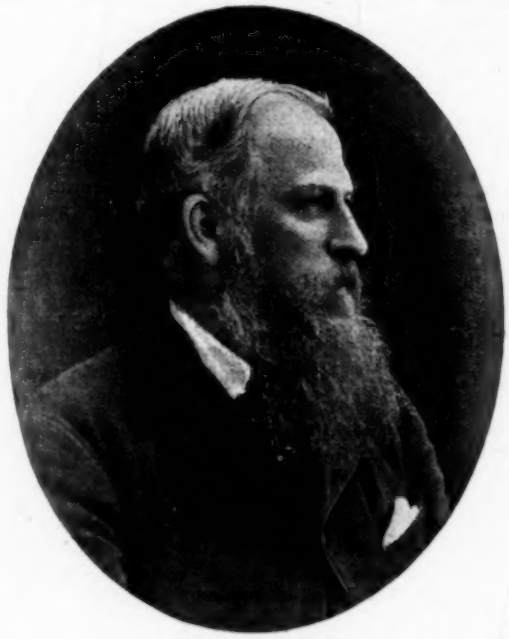
Authorities of training colleges have now the right to demand what has hitherto been accorded as an act of grace—namely, that their students may be allowed to attend a school for the purpose of practical instruction in teaching, or for observation, on such conditions as may be approved by the Board.

MEMORIES.*

IT seems only the other day—can it be over a year ago already?—that the glorious company of Scottish story-tellers were rejoicing in the new supply of ammunition provided for them in *Memories, Grave and Gay*, by the "grand old man" of Scottish school inspectors, Dr. Kerr, to whom, by the way, we should not have dreamed of applying the adjective "old," despite his threescore and ten, but for the sake of accurate quotation. And now, just by way of a "that reminds me," he presents us with *Other Memories, Old and New*. For these too we gladly acknowledge ourselves his debtor, and if we dared we should still whisper "More!"

We do not propose to consider the book under the two headings which are most in favour with the really up-to-date reviewer—namely, firstly, how the book should have been written, and secondly, why the book should not have been written. We have observed how easily a book which contains Scottish dialect can be disposed of under those heads by a critic who is ignorant of that classic speech; but as even the most cryptic saying quoted in these "Memories" is quite intelligible to the writer, his duty as well as his pleasure points in the direction of trying to give the readers of this journal such an idea of the book as will lead to its acquisition and its enjoyment. With literary criticism or the enumeration of defects which can be alleged against the book we shall have nothing to do; the author has said more in its depreciation than we can honestly homologate, but despite all such defects he considered the work worth publishing. So do we. Here endeth our criticism.

These "Memories" are in no sense an autobiography



DR. JOHN KERR.

—which suggests the remark that a real autobiography of Dr. Kerr would have much interest for all connected with Scottish education, on account of his long and influential connection with its development. Yet they are so far autobiographical that the incidents and anecdotes presented are connected mainly with the personal history of the author. The story of his own education is given more fully than we had heretofore known it. Young men should read this, supplying between the lines what the author's modesty (a quality which he oddly disclaims in another connection) has caused to be omitted.

We like the way in which he completed his divinity course, though foreseeing that he would never seek ordination, but seasoned the dryness of it with a study of anatomy and chemistry. We like even better his refusal to be nominated for a professorship, for which his qualifications were not equal to his ideal. Best of all, perhaps, is his way of facing the financial difficulty of residence at Cambridge—so much saved from earnings as a private tutor, and so much advanced by a

* *Other Memories, Old and New.* By John Kerr, LL.D., author of *Memories, Grave and Gay.* (William Blackwood and Sons.)

friend on the security of an insurance effected on his life for this purpose.

The history of the conquest of England by Scottish men and things has never been fully written, but as regards the part played by "Scotch" properly so called, we fear some responsibility must be laid upon our author, according to his own confession:—

"We dined then at 4 instead of at 7 or 7.30 as now. Supper parties in one's own rooms were, accordingly, common forms of entertainment. I was invited to one of these in my first term by a student of large means. I accepted, and found a magnificent 'spread'—costly dishes, wines of rare vintage, and delicacies of all kinds regardless of expense. It was an exceedingly pleasant party. I told my friend next day how much I had enjoyed it, adding that I was sorry that to return it in kind was entirely beyond my means, and that he must excuse me if in future I should decline a similar invitation: that I could not afford to have a stock of wine, and that I could not rise to a higher level in beverages than sound, well-matured Scotch whisky. If, however, he and others like him could accept such humble hospitality and a modest supper in exchange for the splendour of the previous night, a *modus vivendi* could be found, and I should be very glad. My terms were accepted, with the result that I had as much of the best society in Trinity as was desirable and compatible with reasonable work."

That was not yesterday. England has advanced since then. Where would it be necessary to-day to apologise for "sound, well-matured Scotch whisky"? Given that, the *modus vivendi*, or the *modus bibendi*, is not hard to find.

Dr. Kerr is not so prodigal of his stories in this as in his former volume (we wonder if he is saving up another treat for us), but there are a good many anecdotes which are quite up to his best form.

An analysis of Scottish stories would probably show that ninety per cent. or more deal with the national beverage, eighty per cent. with the national Church, and somewhere about fifty per cent. with the national games of golf and curling. Many of the best, of course, include several of those elements combined. In the present volume we have tales of the normal types referred to, and others not essentially Scotch. Of the latter class the following is very neat:—

"A Berlin professor on a visit to England was being entertained at Cambridge, and took occasion, with very questionable taste and in a very bumptious way, to poohpooh English learning, ending with, 'Why, in English you have not even a word corresponding to the German *Gelehrter*.' 'Oh yes,' said my friend, the late Henry Sidgwick, with his well-known stammer; 'we have *p-p-p-prig*.'"

We find two Gladstone anecdotes which are new to us, one of which we quote. Mr. Gladstone had been retailing some remarkable instances of his power of recollecting incidents of his early childhood, certain of which went beyond the credence of one at least of his auditors. "This gentleman had the courage to go one better than Mr. Gladstone, and by its absurdity indicate disbelief of their being personal recollections. He admitted that the instances mentioned were very remarkable, but fell far short of those of a certain chief-justice, who remembered that when he was only six months old, and lying in his cradle, he saw the nurse open a cupboard surreptitiously and help herself to a glass of brandy; whereupon he said to himself, 'As soon as I can speak, shan't I tell my mother!' It is a striking evidence of the great statesman's lack of humour that he did not see the object of the made-up story, but in the gravest tones remarked, 'The thing is absolutely impossible.'"

Of stories with the Church *motif* we have some capital examples. One, which might be described as "broader than it is long," hits off the curious type of Scot who is prone to theological discussion when he is no longer entirely sober. "A man in whom this tendency was strong was in the habit, when in his cups, of calling on his minister to have knotty questions solved. The minister was a man of exemplary patience, but on one occasion when Robert came late at night and argumentatively tipsy, he told him to go home and get a sleep, adding that if he would come back when he was sober, he would, as in duty bound, do his best to settle his difficulty. 'Man, minister,' replied Robert, 'when I'm sober I dinna care a d—n for religious conversation.'"

Of the Rev. Dr. Kidd of Aberdeen our author has a new story to tell. When preaching in a Forfarshire church one day from Isa. i. 4, we read, "He began by saying that he did not think that the words he had read applied to all who were now before him, but it would be very strange if they did not apply to some of them. In every congregation there were generally three kinds of people. Some were very good, worthy men and women; others were just middling, and might be better than they were; but others were actual deevils. He did not intend in his discourse to speak to the first kind, who were already good Christians, and not greatly requiring either advice or censure. The second class would be all the better for some plain speaking, but their case was not so urgent as that of the third class, whom he had spoken of as positive deevils. 'To them,' he said, 'I mean to speak.' Then, rolling up the right sleeve of his coat, and stretching out his clenched fist in front of him, he said, 'Now, you deevils!'"

The Scotsman is apt to be a connoisseur in the matter of preaching, and how minute his canons of criticism can be the next quotation will indicate. "Two lads, one the son of a tailor and the other the son of a landed proprietor in the same parish, went through their university training side by side. It was arranged that one should preach in the forenoon and the other in the afternoon of the same Sunday. The fathers of both were present at both services. When they met at the church door, the tailor asked the landed proprietor what he thought of the appearance the two lads had made. He replied that they had both got on well. 'Yes,' said the tailor, 'but I thought my son had a wee bit the advantage in his delivery. You see, I had him at the tailoring in the summer-time when he wasna at the college, and' (making the motion of a tailor sewing with a pretty long thread) 'he had a freer swing wi' his richt hand.'"

As a sample of outspoken criticism of a sermon the following is good:—"Weel, minister, since ye hae speered, I maun just tell ye that I had three objections to't. In the first place, ye read every word o't; in the second place, ye didna read it weel; and in the third place, it wasna worth reading." Occasionally, however, the minister scores. Thus we are told of one subtle humorist who preached his farewell sermon to an unappreciative flock from the words, "I go to prepare a place for you." The point of the story lies in the fact that the preacher had just been appointed chaplain to a neighbouring prison.

We are tempted to go on quoting, but fairplay decrees a limit to this. We add but one story more, as a sample of the theological teaching of former days in the parish school. "A rapid conversion to orthodoxy is recorded of an old teacher who, in examining his pupils on their knowledge of a very simple manual—the Mother's Catechism—asked a boy if God had a beginning. 'No,' said the boy. 'Will He have an end?' 'Yes,' he replied. This was instantly followed by a buffet on the side of the head. 'Will He have an end noo?' 'No,' said the boy, and the master was satisfied."

To sum up the matter in a word, Dr. Kerr's many friends will read his book because of its author; others will read it because of what they have heard of its contents; both will enjoy it.

THE MOSELY EDUCATIONAL COMMISSION.

IN continuation of our previous article, we propose to deal with the individual reports of the commissioners, confining ourselves, owing to space limits, to a few typical cases.

Professor Armstrong finds American schools very much like our own, with the same problems to solve and the same difficulties to overcome. In matters of organisation and administration we may learn much from them, but as regards method, he considers that we are somewhat in advance. The belief in secondary education is far less general than that in primary education, and is probably no greater than our own; while the polytechnic and technical school movement of this country during the past twenty years is only beginning to come into evidence in the States.

In the common schools, the attention given to reading and composition is in no way sufficient or satisfactory; and, apparently, no greater effort is made in the American schools than in ours to lead children to read, and to become really fond of reading. The teaching of drawing is also undeveloped, and manual training is behind ours in character and value. The nature-study lessons, when not specifically botanical or zoological and scientific in character, were eminently superficial and worthless.

There are two striking features noted about these schools—the air of refinement due to the attention paid to dress, especially by the girls, the preponderating element in most classes; and the attitude of familiarity assumed by the class toward the teacher. The latter is not regarded as a natural enemy, or a person to be circumvented. The method of teaching generally adopted involves a constant exchange of opinion between teacher and pupil, not, as is too often the case in this country, either the mere communication of information to the class by the teacher, or the mere wringing of what is supposed to have been learnt from the pupil by the teacher. The advantages of the method are the development of a readiness of address, freedom in expressing an opinion on any subject, and the encouragement of cuteness. Its disadvantages are the greater burden imposed on the teacher, and its interference with close study and concentration of attention. There is no enforcement of discipline by means of penalties or prizes. Children are put on a footing with grown-up people, and treated as young republicans. Discipline is maintained owing to the presence of girls with the boys, and to the hold the teachers have on the class consequent on their maintaining the interest of the pupils. Professor Armstrong comments rather adversely on this; shows that uninteresting work has to be done at times; that the strain on the teacher is altogether too great, and the effect on the pupil often disastrous.

The preponderance of female teachers is also regarded very unfavourably. Speaking of this, he says: "Admitting that it may be possible, even desirable, to bring up the two sexes together in the earlier years of school life, I venture to think that we must sooner or later come to admit that it is wrong to do so during the later years, if the object be to develop a virile man. To put the matter in very simple terms, it seemed to me on the occasion of my former visit—and the impression was confirmed during my recent visit—that the boy in America is not being brought up to punch another boy's head, or to stand having his own punched, in a healthy and proper manner; that there is a strange and indefinite feminine air coming over the men—a tendency towards a common, if I may so call it, sexless tone of thought."

Dealing mainly with secondary education, Mr. C. W. Fletcher has much to say that should prove of great value at the present time. Firstly, education of all sorts, but especially higher education, is more widely appreciated by employers, as well as by parents and pupils. Managers of great industrial concerns seek the college man, and in many cases will take no other. They seek him not because of his familiarity with their business, or with any details of their transactions, but solely for the training he has undergone, feeling sure that he will show the adaptability, judgment, and power of command required in any responsible position. Again, there is a readiness on the part of employers to engage young men of twenty-two to twenty-six making their first start in business life—a marked contrast to the feeling, still strong in England, that unless a boy begins work at sixteen or seventeen at the latest he will be of no use. This co-operation of employers has resulted in an increase in the number of colleges and technical schools, and in the number of pupils now attending them.

Secondly, the quality of the work (in the schools) is distinctly mediocre. He says, "In some respects the average work is better than ours, but I saw little or none that an English examiner or inspector would call good. On the other hand, the discipline and general tone of the schools is excellent." Dealing more in detail with the above, Mr. Fletcher explains how he arrived at his conclusion. Work was done and accepted which few English teachers would accept, yet he did not see the grossly bad work we sometimes get here. In Latin, for example, he seldom heard an absurd translation; but often the work was inaccurate, with no attempt at elegance, and generally slipshod. In modern languages, mathematics, and science, again, the methods were not what they ought to have been.

Much attention is given to English, both literature and the art of writing, some of the work being most inspiring, and likely to be productive of much good. In addition to reading the literature and noting allusions and tricks of style, an honest attempt was made to get at the underlying thought, to estimate its value, if necessary to criticise and modify it, to cultivate accurate and logical thought, to attain fairness and breadth of mind in estimating motives and character,

and generally to make the study a means of real culture of mind and spirit. Again, this mediocrity may have its good points, as it is partly the outcome of leaving pupils to do things for themselves, and therefore implies that the work is the result of the efforts of minds immature, indeed, but active and fresh. Our pestilent competitive examination system has done much harm in destroying this attitude of mind, not in the best students perhaps, but in the second best, who can be loaded up to the requisite standard, but cannot attain it in a natural, healthy fashion. It seems, however, that there is a waste of two years in the course of study, boys of eighteen doing work that should be very well done by boys of sixteen. The causes of this seem to be the fragmentary nature of the work done, and the absence of any real disciplinary work in the elementary schools up to the age of fourteen. Too many subjects are attempted, and too little time given to each. America, like ourselves, is looking for proper co-ordination between the primary and secondary schools. It is suggested that some of the subjects of the secondary schools shall be taken in the upper part of the lower school; that the teachers of both schools shall visit one another's classes for mutual observation and criticism; that conferences, formal and informal, shall be held more frequently; and that generally the one shall be a continuation of the other, not an entirely new departure.

Among many points of minor interest were noted the excellent equipment of the schools—internal telephones, a system of connected clocks in all the rooms, automatically sounding bells, etc. The absence of playgrounds is compensated for by splendid gymnasia, often with shower-baths and dressing-rooms attached. Corridors are wide, and there is a good supply of lockers. Buildings are always well warmed and ventilated. Every school has a good library, and generally a proper allowance for its upkeep and extension. Every room has its large dictionary on a separate stand, and children constantly consult it. An important point is the universal recognition of the economy of adequate clerical help for the head-master. Nearly always one or two women are employed who attend to the register, look after late boys, receive visitors, conduct correspondence, etc.—they are generally stenographers and typewriters—thereby saving much of his time, and, in fact, multiplying his efficiency manyfold. Again, all teachers are allowed a day or more each term in order to visit other schools. It is universally recognised that teachers should not be actually teaching all through the school day, and twenty or twenty-two periods of actual teaching out of thirty seem about the general rule.

Many of the commissioners give their impressions on the training of teachers, and from these we find that the teachers of the elementary schools usually pass through a period of high school training prior to entering the normal or training school. Their outlook, consequently, is on the average somewhat broader, although the methods adopted in training teachers appear to be no less academic than our own

Professor Armstrong was disappointed, when attending the Columbia Teachers' College, with the high-flown unreality of the instruction given—too much precept, too little practice; no really severe practice.

Mr. Coward, visiting the Massachusetts State Normal College, speaks of the smallness of the classes taught by carefully-selected teachers, whose methods are supposed to be models for the students' imitation. He was struck with the fact that every lesson was given with a view to its being taught again to children; in other words, more attention was paid to the *methods* of the lesson than to the acquirement by the students of information for themselves. Every student is expected to, and does, stand in front of the other students and give a lesson in every subject, the points of the lesson being freely discussed by the other students. The training is for two years at least, and sometimes extends to four years.

Mr. Fletcher thinks the training of teachers is not further advanced in America than with us. All the normal schools put together can hardly turn out a quarter of the annual supply needed for the elementary schools. Secondary teachers, in general, are not trained at all, although departments for this purpose are now being developed at some of the universities.

The Rev. H. Gray was struck with the grasp of the scientific principle in teaching possessed by the elementary teacher, and, in a much less degree, by the secondary teacher. This he attributes to the complete course in the theory of teaching, and the principles of psychology that must be taken by every student before being permitted to teach at all. He comments on the preponderance of women teachers, and its effeminating effect on the American youth; also on the unattractive prospects and the insecurity of tenure as accounting for the dearth of male teachers.

The Rev. A. W. Jephson found that the training of teachers varied with the different states. New York was able to get the necessary material for its schools, but less-favoured spots suffered considerably in competition with the wealthier and more populous centres. The Peabody Training School in Nashville, Tennessee, proved very interesting. "The tone, spirit, and enthusiasm of the 214 men and the 354 women being educated there was delightful, and we carried away from it an intense desire to see institutions of this kind common in our own land." One other feature of American training for teachers was the wide development of classes held by the universities in the summer time, at which arrangements were made for giving short courses of instruction on subjects suitable to those engaged in teaching.

Technical education is dealt with in a lengthy report by Mr. R. Blair. A comparison is made between the British, German, and American systems, and details given of the various trade schools, secondary technical schools, and schools for captains of industry.

Many other points worthy of attention are to be found in the reports dealing with specialised work, but it must suffice in this notice to mention the excellent report of Professor Ayrton, dealing with the education of the electrical engineer; the reports of Drs. Bradford and Gaskell, dealing with advanced subjects of medical instruction; and those of Professors Gregory Foster, Reichel, Rhys, and Ripper, each of which would repay perusal by the careful reader, and add much to the knowledge of the specialist.

INSPECTORS OF SECONDARY SCHOOLS.—The Marquess of Londonderry, President of the Board of Education, has made the following appointments of Inspectors under the Board:—Mr. James Wycliffe Headlam, M.A.; Mr. Robert Pickett Scott, M.A., LL.D., Head-master of Parmiter's School, N.E.; and Mr. Frederic Spencer, M.A., Ph.D., Rector of the High School, Glasgow. These officers will be entitled "Staff Inspectors of Secondary Schools," and will assist the Chief Inspector of Secondary Schools, Mr. W. C. Fletcher, whose appointment was announced in December last.

MENTAL BACKGROUNDS.

BY J. ADAMS, M.A.,
Professor of Education, London University.

(*Continued.*)

THE best class of minds are provided with what may be called *mobile* backgrounds. They are neither fixed nor wavering. They remain steady as long as they are required steady, but are ready for immediate change if that is found desirable. Nimble-witted people—those that in America are specially known as *live men*—are marked by a high degree of mobility of background.

In order that one figure may correct the error of another, let us take the stream figure and the background figure together. The background figure leaves us at liberty to assume an immediate change of background at any moment. The stream figure would make this impossible. We cannot change the full body of a river in a twinkling. Time is needed for the water to pass and be replaced. But as each figure represents one aspect of the truth, we must find the solution of the problem in some explanation that will reconcile the apparent contradiction.

Take the case of a congregation listening to a sermon, or students to a lecture, or a person reading a poem. In the sermon, as a rule, there is no call for violent change of background. Frequently, indeed, the general lines are laid out beforehand, the heads are given, and the work of the preacher is to develop these heads, the work of the listener to supply the appropriate and slowly-changing background. So with the instructive lecture. Fact after fact is introduced, but for each fact a place has been prepared. At the very start of the lecture the teacher—if he knows his business—has referred to some fact (or facts) that he is sure lie within the knowledge of his students. This prepares the way for the establishment of a background different from that which previously existed in the students' minds. As a rule, that previous background is not of much consequence. It is usually made up of floating ideas of omnibus, or stairs, or notebooks, or whittling pencils. If the students have just come from an examination, or from a college row, or even from a specially interesting lecture, the nature of the background may be much stronger, and much more difficult for the new lecturer to deal with. Under adverse circumstances like these the teacher has two courses open to him. He may begin with a particularly striking sentence, in the hope of causing a rapid change of background—that is, he makes an assault upon the attention in the hope of taking it by storm. Or he may begin by saying nothing of much consequence for the first five minutes, in the hope that the old background will gradually give way, and enable him to establish a new one as soon as he begins to deal with the real matter of his lecture. This latter method is, on the whole, the more likely to succeed. Replacing the old background item by item is a much more hopeful thing than an attempt to work the conjurer's wand. A background cannot be called up at will. *Recall* is not quite the same thing. It is perhaps not very difficult to reinstate the background of a previous lecture. Indeed it must be very easy, for all the help students usually get is the dry paragraph that follows the invariable opening—"Gentlemen, in our last lecture;" but a real beginning is different. Why is it that the experienced railway reader prefers to start his journey with a "begun" novel? And if it is a little tiresome beginning a novel, why is it still harder to begin to read a play? The answer is clearly that in both cases there is no background, and that in the case of the play the background is more remote than in the novel, where the author at least does his best to help the reader in supplying a background.

In reading a poem we are often called upon to make rapid and violent changes of background. How does this agree with the stream theory? The answer is that the main body of thought remains constant, in spite of the rapid changes called for by the accumulated figures of speech. The *as* of the figure suspends the interest of the reader till the corresponding *so* releases it again. At Vergil's *as when* we leave the Trojans and accompany him to the teeming bee-hive, but at his *not otherwise* we gladly return to Æneas and his men. While we are with the bees, what has become of the Trojans? Has the background of country life displaced entirely the background of the field of battle? Are our thoughts with the bees or with the Trojans? Different minds act differently here. The fixed mind prefers to remain with the Trojans; it resents this interruption, looks at the bees with disapproval, waits impatiently till the poet sees fit to return to his proper work. The unstable mind, on the other hand, accompanies the poet gladly, forgets all about the Trojans, and revels in the new scene. The mobile mind readily supplies the new background necessary, and *seems* to forget the old. But his enjoyment of the new background is modified by the fact that it has a relation to the old. The country scene has a different charm for him here from that it would have had it occurred in, say, Wordsworth, where it would appear for its own sake. It is a case of turbid media.

Some minds treat illustrative figures more from the point of view of the illustration, others more from the point of view of their intrinsic attraction. Certain minds keep the Trojans before them all the while they are considering the bees. The interest for minds of this class lies mainly in the relation between the two sets of ideas. Other minds can suspend the Trojan background for the time being, without letting it disappear altogether. The charm of comparison comes after the figure has been enjoyed for its own sake. Yet even while the figure is present it cannot be treated quite as if it were an independent subject of thought. It lies on the surface of the stream of thought, it is true; it cannot be denied that it is focal, but the influence of the whole undercurrent of the stream is felt—the sub-conscious body of the stream influences our treatment of the surface current.

It is in the practical affairs of life that there is a call for sudden and more or less complete change of background. The different business calls a man receives in his office every day need not involve a greater change than that we have seen in reading a poem. There is sufficient continuity to maintain the connection between the parts. But if a man is interrupted in his business by household cares, and by, say, church concerns, the difficulty of maintaining a stable background is greatly increased. A man called suddenly from a hard bargain with an American merchant, to deal with a delicate case of conscience, can hardly make the necessary change of background with the required rapidity. In this case there is to be a complete change in the body of the stream

before the required state of mind can result. What happens, as a matter of fact, is that at the beginning of the new interview there is a good deal of confusion of thought. The new background is not distinct. It is affected, according to the laws of turbid media, by the background that has not yet had time to disappear. In a short time thought becomes clearer, ideas are reduced to their proper place, the old background becomes dim enough not to influence the new, and the change is effected.

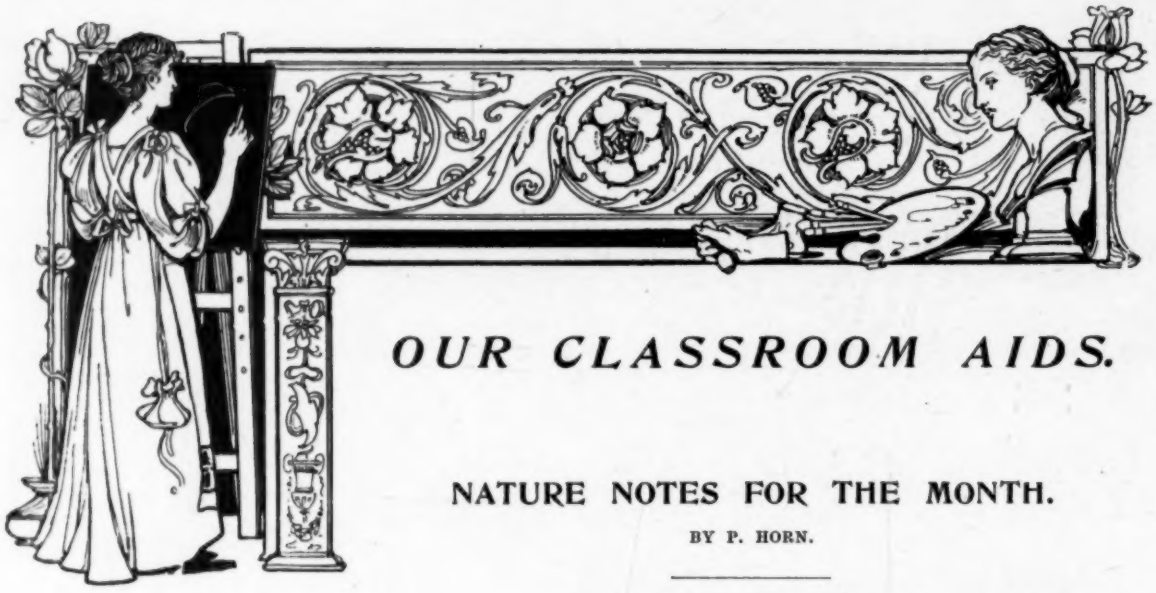
So far we have been dealing with backgrounds in a more or less figurative way; but there is a sense in which they may be treated literally in connection with the psychology of illustration. In all descriptive writing or speaking it is assumed that the reader or hearer is able to supply a background against which the ideas presented may be projected. When the novelist lays his scene in a Norman castle, he takes it for granted that his readers know what a Norman castle is; and if he feels called upon to expand into description, he concerns himself entirely with those parts of his castle that are more or less peculiar to it. As a matter of fact, we have all a supply of ready-made backgrounds that are in themselves invariable. The skill of the poet, the teacher, or the novelist is shown in his way of modifying those backgrounds to suit his needs.

The first general remark to be made about those ready-made backgrounds is that they vary according to the preferred sense of the persons to whom they belong. It is well known that minds differ in the class of impressions that affect them most. There are those who depend mainly upon the eye. Those are named *visuals*. For them everything must be expressed in terms of form, size, and colour. *Audiles*, on the other hand, prefer to deal with sounds. An audile enjoys being read to; a visual is unhappy unless he reads for himself. At the play, the visual is most impressed by the scenery; the audile with the dialogue. Those that are known as *tactiles* reduce everything, as far as possible, to impressions of the sense of touch. When we speak of a cat, the visual has an impression of its size, colour, and form; the audile remembers its purring or caterwauling; while the tactile reproduces in his consciousness the pleasant feel of its fur. The senses of smell and taste are not usually included in this classification, merely because they are so much less important in the problem of knowledge. There is no doubt, however, that they also make a considerable difference in the way different people regard the same thing. A caution is here necessary, as usual. We must not make the distinction too marked. It must not be supposed that an audile does not have visual impressions, or a visual tactile impressions; all that is implied is that the visual or the auditory impressions have the preference.

In speaking of mental backgrounds, most of us have the prevailing impression of sight. For this there are two reasons. On the whole, there are more visuals than audiles or tactiles; but, in addition, the very word background drives us by association to visual impressions. Moreover, for the purposes of school, visual backgrounds are more useful than any other, for the very plain reason that we can, to some extent at least, compare them with each other by means of an external standard. If I ask you to think of a country town, a picture at once arises in your minds. That is your picture of a country town. If you analyse it, you will probably find that it owes most of its characteristics to one particular town with which you are most familiar, or in connection with which you first made acquaintance with a country town. Further, paradoxical as the statement is, the fewer country towns you have seen, the clearer is the picture that rises in your mind. To one who has known a great number of such towns there is a vagueness about the picture. The peculiarities of the different towns are contrary ideas, and therefore arrest each other. If now the man of many country towns is determined to have a clear picture, he can usually succeed; but the price that he pays is the loss of the picture of a country town in general, and the adoption of a particular town. His town is the pictured image of what he has actually seen.

A very interesting as well as useful exercise is to take up the catalogue of an art exhibition before seeing the pictures, and try to realize what sort of picture corresponds to each of the descriptive titles. The man of many galleries succeeds fairly well. His mental picture of even such a vague and tantalising description as "Portrait of a Lady" is not usually far out. But to the ordinary lay mind there will be little but disappointment. "Chill October," "With Daisies pied," "In Spate," "Where the bee lurks," "Boors Drinking," "The Village Wedding"—all raise pictures in our minds that do not at all correspond to what we find in the frames. Yet we cannot blame the painters; in each case we are constrained to admit that the picture justifies the name, and in most cases we are prepared to admit that the painter's idea is better than ours.

Now if any practical issue depended upon this description, how easily you might be misled! Your picture corresponds *at all the points of contact* with the description, but at all other points your picture is independent of the reality. Let us not forget that the very vagueness of our backgrounds is not without its use. It is this quality that enables us to fit them in so easily into so many different frames. If any discrepancy arises, it can be readily remedied; while as for the rest, it does not matter. We sometimes forget how much work the reader has to do. The writer no doubt brings his ideas together and lays them before us with more or less skill; but the reader has to supply his own backgrounds, and see that they agree with the ideas projected against them. Sometimes it happens that a discrepancy arises because the idea was originally presented against a false background in the mind of the writer, and the error is detected by the more accurate background of the reader. More frequently, however, the reader's faulty background is exposed by the process of projecting the writer's ideas against it. A schoolboy objected to his lesson-book for speaking of an attempt on Edinburgh Castle being made from the steep cliff on the west side. His argument was that the steep cliff was on the east side. When asked to justify this remarkable criticism, he had nothing to say but a reiteration of the fact, which to him seemed self-evident. It was only when hard pressed by his teacher, who pointed out that the access was quite easy from the east, that the boy scornfully explained that climbing a high cliff out of small boats was not what he considered an easy approach. The mention of boats led to further inquiries, when it came out that the boy was dealing with the only castle he knew, which happened to be Dunnottar Castle, where certainly his objections held. He had simply taken the word castle to connote *all* the elements of *this typical castle*.



OUR CLASSROOM AIDS.

NATURE NOTES FOR THE MONTH.

BY P. HORN.

Hay-Time Gossip.

THE British farmer is proverbially a grumbler, but really there is small cause for surprise when we come to consider the origin and extent of his little worries. Six weeks ago the young fruit was at the mercy of untimely frosts; and now that the fruit crop is assured, the hay is the cause of the anxiety. Whilst the long grass remains standing, a spell of rainy weather has no ill effects—in fact, if not too violent it is advantageous; but once the scythe has passed over the field, then wet weather is not wanted.

The new-mown hay—if hay it can be called at this stage—must remain on the field until it is properly dry, and the speedier this takes place the better. A shower of rain merely has the effect of setting back the clock, to use a familiar expression; but prolonged rain may prove to be a very serious matter, for the winter provender of the cattle is not improved by long contact with the damp earth. Last June the dilatory people who delayed mowing had the satisfaction of seeing their crop lie deteriorating on the sodden ground, whilst they waited in vain for the necessary few days of continuous sunshine. In one particular instance I recall to mind the blackened stems were not carted until August.

Hay which has been ricked before it is properly dried has an unpleasant habit of becoming mildewy, or, worse still, it may develop enough heat to ignite itself by spontaneous combustion. So evidently it does not pay the farmer to be slovenly with the drying process; for, apart from waste of material and from malodorous smell, a rick with a smouldering interior necessitates a great deal of labour before matters can be rectified. The usual method is to remove the charred portion bodily. After this the rick is left open in order that the drying air may have access; subsequently the whole is filled in and rethatched.

Nowadays the larger farmers have recourse to the aid of modern machinery for the purpose of cutting and ricking, but the holders of a few acres still adhere to the time-honoured use of scythe and pitchfork.

The ease and dexterity with which the labourers swing their awkward implements is apt to give the uninitiated the impression that mowing is an extremely easy task, and perhaps the visitor is tempted to show the natives how it should be done. However, it is advisable to stand clear of the novice; for if the first stroke does not drive the point into a convenient ant-hill, the next swing will assuredly bring the weapon skimming over the surface towards the legs of the nearest bystander—and the blade of the scythe is keen and far-reaching.

The mowers occasionally come across objects of interest in the course of their labours. A friend of mine once laid bare a hollow containing a hedgehog and five young, two of which, rescued from the ever-present small dog, subsequently proved to be interesting pets in a London garden.

Occasionally a nest of partridge's eggs is found amongst the rank growth by the hedgeside. If the eggs are on the point of hatching, the devoted mother is extremely reluctant to leave her charges; consequently she sometimes falls a victim to the sweeping blade.

Hay-time is the wedding season of the grass, when every flower-tipped stem endeavours to thrust its burden up as high as possible, so as to ensure the thorough distribution of the wind-borne pollen. The flying particles of this self-same pollen are said to be the cause of that interesting malady known as "hay fever."

Each stem is beautifully constructed; in fact, the cleverest engineer could not have designed a better one for its special purposes. In order to support the weight of the flowers or fruits, a certain amount of rigidity is necessary. At the same time the stem (often two or three feet long) must be flexible enough to sway and give with the pressure of the wind. The method in which these desirable conditions are secured is best explained by the actual examination of a straw, or better still, for class purposes, a piece of split bamboo.

A combination of strength, rigidity, lightness, and economy of material results from the stem being hollow instead of solid. A hollow tube is stronger than a correspondingly long bar composed of the same quantity of material—a fact which is taken advantage of in the construction of the modern bicycle.

Again, the stem tapers throughout its whole length, the greatest thickness being at the bottom; consequently rigidity increases as we approach the ground, away from the sphere of the wind's influence.

The well-known splitting property of the stem informs

us that the hollow tube is built up of long pliant rods, arranged and fastened together side by side.

Here is the origin of the flexibility which allows the stem to bend but not break. In order to strengthen the tube and check the natural tendency of the rods to split asunder in the event of a great lateral strain, the tube is crossed at intervals by comparatively solid partitions. These give rise to the bulging knots so familiar in the straw and bamboo.

Further and more detailed information on this interesting subject may be found in Miall's *Round the Year*.

Insect Arrivals.

Pupæ-rearers may expect the following to emerge shortly: swallow-tail butterfly, eyed hawk, lime hawk, privet hawk, puss moth, cream-spot tiger. Added to these, the collector will be sure to capture the buff tip, magpie (plentiful in London), gray dagger, and sycamore moths.

The pupæ should be kept in a warm, moist atmosphere (on damp moss, for instance); otherwise they are apt to produce cripples—that is, insects with dry, shrivelled wings which never unfold. The cream-spot tiger is likely to prove a bad speculation if these matters are not attended to.

In passing I might mention that in the May *Pearson's* there is an excellent illustrated article on the life history of that typical early butterfly the orange tip, which I casually mentioned last month in connection with the subject of food plants.

Material for a Lesson on Feather Growth.

In one of the recesses on the left-hand side of the big hall at South Kensington there is an interesting set of examples illustrating the growth of the feather.

The whole series is too detailed for the average person, much less the child, to grasp in the short space of thirty minutes; so I have endeavoured, by taking the young thrush as an example, to bring out one or two points which may be of service in building up a lesson on feather growth. The young thrush is born naked, with the exception of one or two particles of fluff on the head.

The above-mentioned points are as follows:—

1. How feathers grow.
2. When they grow.
3. Why they grow in certain positions.
4. Practical illustrations.

The feathers of the bird, the hair, teeth, and nails of mammals, and the scales of fishes are scientifically known as "outgrowths of the epidermis." In plain English, they are composed of, and spring from, the substance of the outer skin. Each feather has its origin in a group of active little cells situated at the bottom of a well or "follicle" of the skin.

The first portion to be constructed is the tip, and each successive layer of new material forces the preceding deposit higher up the tube in the form of a cylinder. The little cells below work with great rapidity, continually adding fresh material to the rapidly lengthening structure; so that in a short time the end of the cylinder is thrust forth into daylight. When the bird is six days old the protruding tips become very numerous on certain parts of the body, causing the surface to have a rough, unshaven appearance.

On paying a succession of daily visits to the nest, we find that the projections are rapidly lengthening out into quill-like processes. Moreover, the wings and tail also contribute their share of spines, so that our young friend begins to look like a disreputable porcupine rather than the offspring of a sprightly bird. So far there has been no actual sign of the familiar feather; but wait awhile and see what these wonderful quills produce.

In a few days they burst at the tips, and now for the first time we catch a glimpse of the feather peeping shyly forth from the split end.

The structure of the quill is now revealed. Each pale blue shaft is a more or less complete feather tightly packed and wrapped about in a thin covering of transparent skin. Why does the feather appear in this manner? the inquiring mind naturally asks. Take one, strip it of its disguise, and the answer is at once apparent. The young feather is damp and limp, and by reason of its weakness would be speedily twisted out of shape by the weight of the bird if it were not for the bracing effect of the outer covering. Again the skin binds the rami (the feathery portions) tightly against the central stem, so as to form a comparatively rigid rod; and as any one can see, this is a distinct advantage, for the feather alone, from its very structure, would experience some difficulty in pushing its way *tip first* up the follicle. Try the experiment with a piece of narrow tubing, and observe the condition of the feather afterwards.

The young thrush now looks extremely comical in his quaint costume, for the partially uncovered feathers, with their protruding tips, remind one irresistibly of an array of artist's pencils. However, this unique effect soon disappears, for on each succeeding day the strengthening feathers throw off scurf-like flakes of the wrappings, every movement of the bird accelerating the disintegration. In the case of the greenfinch the wool-lined nest retains the castings in the form of a mealy powder, but the hard, smooth interior of the thrush's nest does not appear to lay hold of the powder—at least I have never noticed it. The casting process begins before the feathers reach half-length, so that by the time they are full grown the bird is completely peeled, and ready for flight.

The feathers are not scattered uniformly all over the body, like the scales of fishes, but they grow in well-defined lines and patches, technically termed "tracts," with intervening spaces of bare skin.

These tracts, of great significance to scientists, are best observed when the bird is a week old; so, aided by the diagrams, we will again take a glance at the young thrush.

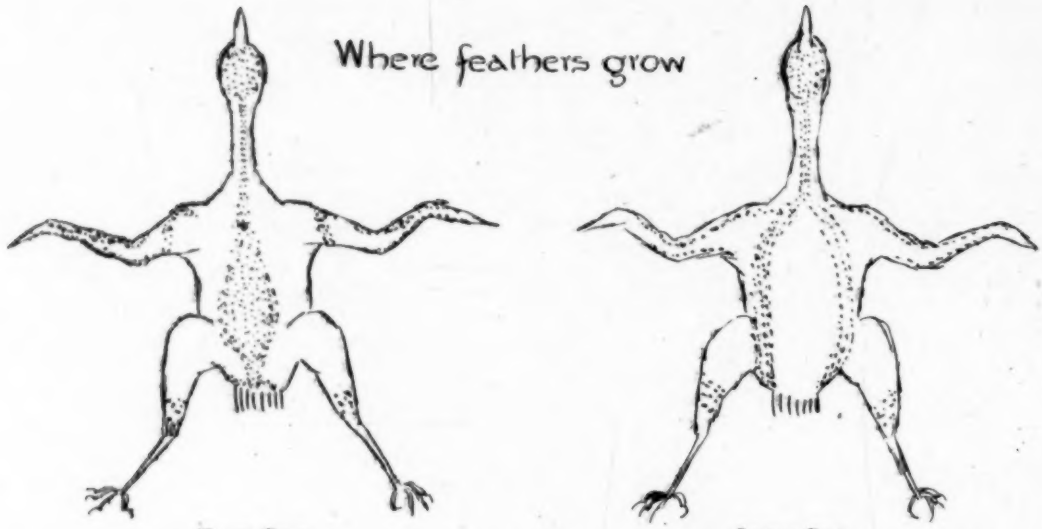
On the upper side a band runs from the head, which is uniformly covered, down the neck, and along the centre of the back to the tail, widening out over the region of the loins.

On the under side there is a corresponding line continuing to the base of the neck; but here it branches into two routes, which traverse the sides of the chest, and reunite by the tail, after crossing the thighs. Small disjointed offshoots also spring from the neck junction to the wings.

Why this apparently unfair distribution?

Suppose an active bird like our thrush were uniformly covered with contour feathers. Its movements would be considerably hampered by the presence of feathers in the wing joints and other places where a great deal of work goes on; besides, the condition of the offending plumage would not be improved by reason of its awkward position.

Wherever there is work or friction, there the contour

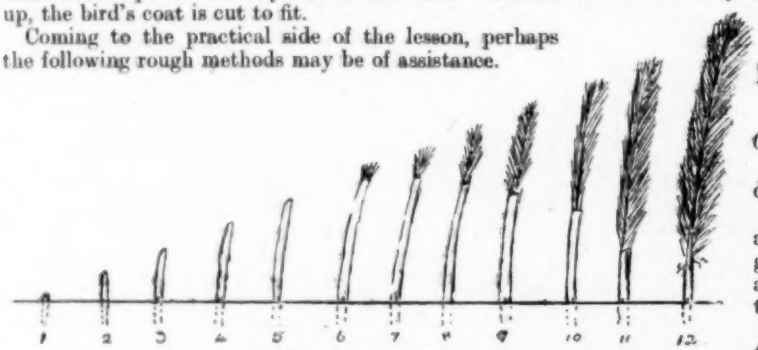


UPPER SIDE. LOWER SIDE.

feathers are absent, their place often being taken by an inferior growth of short, yielding down which allows great freedom of movement.

The smooth, unbroken surface of the plumage is due to the tendency of the feathers to lean towards and overlap their neighbours in the adjoining tracts. Each tract, too, has underlying muscles which automatically twitch the feathers into the required position, so as to accommodate the bird's every movement, and at the same time to preserve the symmetrical surface. To sum up, the bird's coat is cut to fit.

Coming to the practical side of the lesson, perhaps the following rough methods may be of assistance.



HOW FEATHERS GROW.

Procure a dozen long feathers, preferably those from the wing of a turkey or some other large bird. Cut an inch from the tip of the first, two inches from the next, and so on until there is only one feather remaining entire.

Put the quills (the thick hollow ends) aside, and wrap the remainders tightly in thin tissue paper. Let a piece of modelling composition or clay represent the bird's body. First few days no growth apparent; next the tip of the wrapped feather is seen just protruding from follicle. Make follicle with penholder, and insert No. 1, the smallest tip, so that it just shows above the surface. Next replace with second shortest (don't alter depth of follicle), and so on until No. 6 is reached. After No. 7 has been reached, tear off a small portion of the tissue paper covering, so as to expose the hidden feather.

Do more so to No. 8, and continue until No. 12, the entire feather, is reached.

The diagram will explain matters more fully.

It would be advantageous to show a dead starling or some other common bird for the purpose of illustrating the distribution and method in which the feathers are arranged; but failing this, a blackboard copy of Diagram 1 will serve to complete the lesson.

Cyclists who find themselves in the neighbourhood of Stanmore towards dusk may be fortunate enough to see and hear the night-jar; for a pair of these interesting birds were very much in evidence last June, hawking over the woody common at the top of the hill.

NOTES OF LESSONS ON THE SWALLOW.

Class.—Standards III. and IV.

Time.—About an hour, preferably divided into two half-hour lessons.

Aim.—As in all nature study, the aim should be to cultivate the intelligent observation of the living things around the children, and thus to bring the latter in sympathy with nature.

Step I. Preparation.—In the country the children should be encouraged to observe the birds found in the neighbourhood, particularly to note their appearance and song. In the case of migratory birds a diary should be kept to record the dates on which the various birds made their reappearance. The children should also note the position, shape, and structure of the nest.

In the case of town children, much will have to be done by means of pictures. Children should have an opportunity of studying beforehand pictures of the swallow, the martin, and the swift, and also, for purposes of comparison, of the robin, the sparrow, and the fowl. In London and many other large towns a section of the museum is devoted to natural history. This affords the children an opportunity of studying the size, plumage, and colour of the bird, and often they are able to see excellent models of the nest.

Step II. Presentation.—1. *The Migratory Habits of the Swallow.*—Those children that have made a practice of noting the ways and habits of birds will know that the

swallow is not seen during the winter. In this respect it resembles the squirrel and the dormouse, but its method of passing the winter months is totally different from the way these animals pass them. When the squirrel finds the winter coming on, he hides away and sleeps through the cold weather; but when the swallows find the trees are putting on their autumn tints, and the supply of insects is getting scarce, they gather in large flocks, and may be seen by hundreds perched on trees and the roofs of houses. After holding a kind of parliament for two or three days, they set off on their travels.

THE SWIFT.

2. *The Nest.*—The structure of the nest should be noted. In shape the nest is broad and shallow. It is formed of mud and clay collected from the side of a pond or stream, and mixed with grass and straw to prevent it crumbling to pieces when it dries. The inside is snugly lined with feathers and other soft material. The nest is built in a sheltered spot such as the eaves of a house, a hole in the side of a pit or quarry, or the under side of an arch. The swallow is not afraid of human beings, for it generally builds its nest near human habitations; and in the case of the martin or window swallow, it apparently becomes attached to a certain spot, for it almost invariably returns to its old nest. The sand martin prefers a sandbank or cliff of soft sandstone. In this it bores a hole two or three feet deep, and considering its imperfect tools, it makes its way with extraordinary rapidity. It appears to possess some knowledge of hydrostatics, for its hole always slopes upwards to prevent the water collecting in it; and there is generally a sharp turn at the end, affording the nest some protection from the wind.

3. *Eggs and Young.*—The common swallow lays from four to six eggs. These are white, but speckled with gray or brown spots. The eggs of the house martin are perfectly white, and somewhat longer in shape. The parents show great affection for their young ones, and it is most interesting to watch the old birds teaching the young ones to fly.

4. *Food of the Swallow.*—The swallow feeds wholly upon flies and other insects, which it catches while on the wing. The total number of insects devoured by a single pair of swallows and their brood is almost incredible. When collecting food for its young, the swallow retains the insects it catches in a kind of pouch under its tongue; and birds have been frequently captured with sufficient insects crammed into this pouch to fill a teaspoon. In damp weather, when the air is laden with moisture, the insects fly near the ground, and therefore the swallows have to fly low in order to capture them. On the other hand, when the air is dry the insects are found higher in the air, and so the swallows fly at a considerable height from the ground. This has led the country-folk to use the flight of the swallows as an indication of the weather. Similarly, the preference of the swallow for the neighbourhood of streams and ponds is due to the large number of insects that are found there.

5. *Structure of the Swallow.*—The three most striking points about the swallow are its wings, its mouth, and its feet, and the children should be led to see for themselves that these are specially adapted to meet the habits and requirements of the swallow.

(1.) The wings. As the swallow lives entirely upon insects which it catches upon the wing, its flight must be particularly rapid and easily directed. For this end it is provided with a large expanse of wing to aid its flight, and a long, forked tail to serve as a rudder in directing its course. If a stuffed bird can be obtained, these points can be impressed on the children by actual measurements. In the case of the swift the body is less than four inches long, but the tail is about five, while the wings often stretch as much as eighteen inches. The feathers of the body are firm and close, so as not to impede the passage of the bird through the air.

(2.) The mouth. No matter how swiftly the swallow might fly, it would be unable to capture its prey unless it were provided with a large mouth. The beak is soft, as its food consists only of soft-bodied insects.

(3.) The feet. As the swallow obtains the whole of its food in the air, it is not necessary for it to settle on the ground; consequently the legs are short and weak, as they are seldom used. If by any chance the swallow does settle on the ground, its locomotion is most slow and awkward. So small are the feet of the swift that the scientific name of that bird means "the footless swallow." The whole of the toes point forward, so that when it settles it clings instead of perching.

MOUTH OF SWALLOW. FOOT OF SWALLOW.

Step III. Association.—During the lesson the teacher would, by means of comparison and contrast, associate the children's ideas of the swallow with their ideas of other familiar birds, such as the sparrow, robin, and fowl, noting particularly in what points these birds differ and in what points they are alike in structure, and lead the children to see that difference of structure indi-

cates different habits in the birds. Thus the soft bill of the swallow, which is only required for eating the soft bodies of insects, would be perfectly useless to the sparrow or the robin, which require a hard bill to

Mouth of Robin. Foot of Hen.

crack the seeds and remove the grain from the husk. So, too, the wings and the feet should be compared, to bring out the enormous stretch of wing which the swallow has for its size, and its comparatively useless feet.

Step IV. Formulation.—1. The swallow is a migratory bird, leaving about October and returning towards the end of April.

2. The nest is built of mud mixed with straw.

3. The swallow lives entirely on insects.

4. The most characteristic points in the build of a swallow are :—

(*a*) Large wings and long tail.
(*b*) Wide mouth and soft bill.
(*c*) Legs short and weak, and toes all pointing forward.

Step V. Application.—The chief practical application of this lesson will be the utilisation of the ideas that have been acquired in the intelligent observation, not only of swallows, but also of other birds. The swallow, too, has so endeared itself to the heart of the people that it is constantly figuring in literature, and this lesson could be followed after a time by a literature lesson dealing with these allusions ; for example :—

The Return of the Swallow.

"One swallow does not make a summer."
Old Proverb.

The Nest.

"The breezy call of incense-breathing morn,
The swallow twittering from its straw-built shed,
The cock's shrill clarion, or the echoing horn,
No more shall rouse them from their lowly bed."
Gray's *Elegy.*

Teaching the young to fly.

"And as a bird each fond endearment tries
To tempt its new-fledged offspring to the skies,
He tried each art, reproved each dull delay,
Allured to brighter worlds, and led the way."
The Deserted Village.

The Departure of the Swallows.

"When autumn scatters his departing gleams,
Warned of approaching winter, gathered, play
The swallow-people ; and tossed wide around
O'er the calm sky, in convolution swift,
The feathered eddy floats."
Thomson's *Seasons.*

The Secretary for Scotland intends to arrange for a permanent representation in Edinburgh of the Scottish Education Department. In order to facilitate the reorganisation thus involved, Sir Henry Craik, K.C.B., Secretary to the Department, has now retired from that post, which he has held for nineteen years.

PRACTICAL HELP IN THE ARITHMETIC LESSON.

BY GEORGE COLLAR, B.A., B.SC.,
Joint Author of "A New Arithmetic," etc.

IN our last paper we led up to the fact that the greatest common divisor of two or more numbers is the product of all their common prime factors. This may be given as the definition of the G.C.M. instead of the usual one ; and it is just as logical to start with this definition, and show that the number so obtained is the highest number which will divide each of the given numbers, as to proceed in the converse order, and show that the G.C.M., as usually defined, consists of the product of the prime factors ; and children who base their idea of the G.C.M. on its composition have more power in dealing with abbreviated methods of work and with problems.

As a result of the nature of the G.C.M., it follows that in finding the G.C.M. of two numbers we can (*a*) take out factors that are common and keep these to form the G.C.M., and (*b*) take out any factor that is not common and neglect it, as it cannot form part of the G.C.M. It is advisable to give a series of examples first from which the common factors may be easily taken and the other factors recognised as prime to one another—for example, Find the L.C.M. of 252 and 396. The children recognise that 7 and 11 are prime, therefore 2, 2, 3, 3 are all the common factors. Hence the G.C.M. = 2 × 2 × 3 × 3 = 36.

2	252	396
2	126	198
3	63	99
3	21	33
	7	11

The teacher can easily construct his own exercises by taking numbers that are prime and multiplying them by the same number—for example, 3 × 17, 3 × 19—that is, 51 and 57 ; 24 × 9, 24 × 8—that is, 216 and 192.

Find the G.C.M. of (*a*) 336 and 462, (*b*) 310 and 403, (*c*) 315 and 225, (*d*) 448 and 640.

The next step is to give practice in picking out factors that are not common, so as to arrive at the common factors at the end. It is important to impress children with the purpose for which factors not forming part of the G.C.M. should be removed, and the operation may best be compared to the work of a sculptor who chips away the superfluous pieces of marble from a block and leaves the statue, which was inside the block all the time. These examples are formed by taking a fairly high number and multiplying it by numbers prime to one another, and which are composed of simple factors—for example, 37 × 2 and 37 × 3—that is, 74 and 111 ; 217 × 12 and 217 × 25—that is, 2604 and 5425.

2	74	111
	37	37

In working these examples children should be taught to cross out the divisors that are not common. It must be pointed out that the divisor 3 may be written to the right, or that, in fact, divisors which are not common factors need not be written at all.

Find the G.C.M. of (*a*) 405 and 567, (*b*) 248 and 465, (*c*) 3892 and 4665, (*d*) 3375 and 3750.

The children should be encouraged to form examples of these types after a little practice in working them.

Before proceeding to deal with cases which they cannot bring out by inspection, the children should be made familiar with the three fundamental rules :—

1. If a number is a factor of each of two others, it is a factor of their sum and of their difference.

2. If a number is a factor of another, it is a factor of all its multiples.

3. If a number is a factor of each of two others, it is a factor of the sum or difference of any of their multiples.

The first two of these rules are axioms—that is to say, they are so simple that they admit of no proof. Not long ago a question in a pupil teachers' examination paper asked the unfortunate candidates to *prove* the first rule. But just as it is impossible to use any arguments to show that if we add a number of horses to another number of horses the result must be a number of horses and not a number of sheep, so also the knowledge that a number of sevens added to another number of sevens must also produce a number of sevens comes by intuition and not by reasoning. The statement of the rule by means of an algebraical formula, as $am + an = a(m + n)$, is not a *proof*, because the formula is based on the fact, and not the fact on the formula.

The third rule is easily deduced from the other two.

The practical use of these rules is best illustrated by taking two lines, say 5 and 20 inches in length. On using the smaller to measure the greater, it will be found to be contained in it four times; and since a greater length than 5 inches cannot be contained in 5 inches, it is evident that 5 inches is the G.C.M. of the two lengths.

Next take two lines 8 and 20 inches in length. It will now be found that the longer line contains the shorter twice, and that there is a piece over. Now use this remainder to measure the smaller line, and it will be found to be contained just twice—that is, it is a measure of the smaller, and consequently it is a measure of the part of the longer line marked off by the smaller, and it is a measure of itself, and so is contained exactly in the whole of the longer line. If the remainder had not measured the shorter line, it would have been necessary to continue the operation; but the reasoning is the same, and too many steps tend to confuse the beginner. This concrete example shows how we can obtain *a* common measure, and a reference to the three rules will show that it is the *greatest* common measure. For if the two numbers contained any other common factor, it would have been found in the remainder.

This mechanical method of working should be resorted to only when factors are not discoverable by inspection; and moreover, after each application of the process the new divisors and dividends should be searched for factors, either common or not common. If children are thus trained to be continually on the alert to discover the factors of numbers, they will not only be able to find the G.C.M. of given numbers readily, but they will gain great power in the numerical calculations generally.

The papers set in arithmetic in the various county council scholarship and similar examinations seldom ask for the G.C.M. of two numbers without some qualification, because the formal method of repeated divisions is no test of intelligence. Candidates are frequently asked to resolve given numbers into their prime factors, *and hence find their G.C.M.* Concrete examples are frequently set, and the quantities are denoted by compound expressions—as, "Find the greatest sum of money which is contained exactly in £1, 13s. 5d. and £2, 7s. 11d." Of course these must be first reduced to pence.

Another common type of problem consists in asking for the highest number that will leave given remainders when divided into some given numbers—as, "What is the highest number that will leave 7 remainder when divided into 7623, and 3 remainder when divided into 9999?"

The children must be taught to see that a number which leaves 7 remainder when divided into 7623 divides 7616 exactly, and the number which leaves 3 remainder when divided into 9999 divides 9996 exactly. So that the problem consists in finding the G.C.M. of 7616 and 9996.

The children themselves can easily draw up questions of this type, and these will not only serve as exercises for the class, but will drive the principles home. The G.C.M. should be arranged first, and care taken that the remainders are less than the G.C.M.

THE TEACHING OF HISTORY BY OBJECT LESSONS.

BY E. A. GREENING LAMBORN, HEAD-MASTER OF ST. MARY MAGDALENE SCHOOLS, OXFORD.

"When your children shall ask their fathers in time to come, saying, What mean these stones?"

THE Old Testament has always been a model of what a successful popular history should be, and it is a guide in teaching the subject of history to-day. The first striking point in the Bible narrative of the history of the Jewish people is that only the most important and interesting periods are dealt with at length and in detail, periods of many years in which no events of cardinal importance occurred being passed over in a sentence—as, "The land had rest forty years." The result of this was that every Jew had his nation's history, as a definite number of distinct pictures of history-making epochs, clear in his mind's eye. He knew the details of each picture and the order in which they came. The spaces between them were as the blank wall or background; they existed as definite spaces of which he knew the extent, but they were neutral-tinted, and he need not, and did not, confuse himself by attending to their minor details. The second point of note in the historical method of the Old Testament is that the history of a period is woven into the history of a person—that is, the history of the nation is taught by the biographies of its history-making individuals. Thus, for example, the lives of Abraham and the patriarchs illustrate the origin of the race in a family, that of Joshua gives the history of its settlement as a nation, and that of Solomon the history of its rise to greatness as a "world power." The result of this was that the subject was concrete and real to a Jew. A common name called up to him the picture of a period. His own name, in many cases, was a historical mnemonic; it assured him of the reality of its former possessor.

These are the two principles of Jewish history which have to some extent guided those who have been responsible for the schemes of teaching English history in the elementary schools of England. But hitherto these principles have only been applied to the teaching in the lower standards of the schools. The Code suggests a list of stories and biographies in the lower classes, and in the upper prescribes one period to be studied in detail each year. This is a distinct departure from, and an advance upon, the Jewish method; but it presupposes that the upper standard boy is as one of the scribes, who, having the Biblical outline of Jewish history clearly in his mind, devoted his attention to a

detailed examination of a special period. And this presupposition is, unfortunately, not justified by facts. The boys have not a general outline of English history clearly in their minds to commence with. Until they possess this, any single period studied in detail is isolated. The boys forget, or have never properly realised, the periods preceding and following the one they are studying, and so the special period stands isolated in time—a link with no visible connection with its chain. It follows, too, that the children do not realise the connection of the period with the present time, and so the growth of present things from past, and the important principle of evolution in history, is lost sight of. Specialisation in any period should only be attempted after a general knowledge of all periods has been gained. A general outline of history as a whole being an essential preliminary study, it is advisable to find first the best means by which such an outline can be obtained. And here the second Bible principle may serve as a guide.

History should be taught as a continuous narrative in a series of connected and continuous chapters, each chapter having some concrete idea, round which its interest centres. Thus the chain of history will resemble a series of pictures, as was the case with the Jew. But the next point is, how to get the central idea of each period firmly in the memory, what to make the nail on which the picture hangs, where to find the concrete material facts which give reality to the subject. The Bible method was to make an individual the central figure of a period. Thus the reality of the subject was brought home to the student. The human interest appealed to him, and he realised that history was made by man, and was not an abstract science like mathematics, whose truths existed irrespective of humanity. The personal element introduced by the central character caused the subject to appeal to his emotions, and not only to his intellect; he felt and thought, rejoiced, triumphed, or suffered with one whose triumphs or sorrows were long ago ended; but so he entered into the spirit of these bygone times, and realised their circumstances and characteristics with a clearness which no other method of teaching would have given him. Therefore a list of biographies of English great men has been chosen by the Board of Education as the fittest introduction to the study of English history. But it must not be forgotten that to a Jew a historic name was a much more concrete thing than it is to an English child. The oral tradition, handed down the generations of a primitive race, made an ancestor a very real personage. To an Ephraimite, Joseph was felt to be as real a relative as an English boy's grandfather whom he has never seen, but whom, from his parents' account of him, he feels he knows intimately. Therefore this method of teaching history by biographies is less valuable, because less concrete, with us than with the Jews. There is a tendency for children to regard historical stories in the same light as fairy tales, and their events as happening in a dim, indefinite past having no connection with the present. Thus Richard the First becomes as unreal and impossible a person as Jack the Giant-killer, but hardly as interesting.

But there was another Jewish method of perpetuating the memory of bygone events, reference to which is made at the beginning of this article. It was to associate these events with a solid and lasting monument, and to use these memorials as object lessons in teaching history to the younger generations. This latter method we in England might well imitate, for it is in accordance with two principles of teaching whose importance is being more and more realised to-day. The first of these is that the most valuable knowledge is that which is obtained by the children for themselves, under guidance, as the direct result of their own observation and deduction. The second principle, that teaching in the elementary school should be made as concrete as possible, is practically a corollary of the first. The realisation of the importance of these two principles is shown by the growing interest taken in nature study. It is now understood that knowledge, like charity, should begin at home, and that it is better, before extending the circle of one's view, to be sure that one possesses a fair knowledge of the things already in it. The subject of history may well be taught on these principles by taking the historic objects and places in which our country is so rich as concrete illustrations of historical periods, using them, in fact, as objects for object lessons by which their history, and incidentally English history, may be taught with a reality and practical value which could never be gained from book-learnt facts alone. Thus the battle-axe of Richard the First will attest without words the might of its former owner; the military genius of the Normans and their skill in building can be better shown by an hour's visit to the neighbouring church or castle than by many lectures in the classroom; and the power of the Church, which was such an important factor in the history of the earlier Middle Ages, has left signs which the eye may be trained to read, in the mouldering but massive ruins of the local abbey.

The purpose of this article is to describe a scheme in use in some Oxford schools by which the history of England in outline is taught by reference to the historic buildings and objects of which Oxford and its neighbourhood are full. Oxford is one of those towns, common enough in England, whose history is practically the history of the nation, and which contain buildings and other memorials of every century which may be made object lessons for concrete history teaching. Teachers, as a rule, have either disregarded these dumb instructors, or at best have alluded to them in passing as being associated with such and such a period. The writer's aim is to show that it is possible to *commence* with these relics, examining and observing them, deducing facts from these observations, weaving the thread of history round them, and making them the centres of historic "mind pictures," as the Bible makes an individual. But they have this advantage, that they actually exist materially. The individual has withered, all but his name.

By these means not only is an outline of the country's history obtained, but also a special knowledge of the district in which the school is situated—which is as it should be.* Also, as every historic place has some particular period in which it was peculiarly important, this method of studying history offers an excellent means for the specialisation in one particular period which the Board of Education recommends in the Code. Further, it is by this method that the facts of history are obtained by historians when written records are incomplete or non-existent; and if the children understand that historical writers obtained their facts in the same way as they themselves do, by observation and deduction, they will better appreciate books on the subject, having something in common with their authors.

It may be objected that very few places exemplify

* See Art. 156, Code 1902.

by their history the complete history of England; but as in no case would it be possible to teach each period in detail in a year's course, some periods must be omitted or barely touched on in any outline scheme. A complete list of biographies, for instance, could not possibly be gone through in a year, and there are hundreds of places whose history touches the history of England in sufficient places to form a series of stepping-stones, bridging the centuries from the earliest times until now. The difficulty in drawing up an outline syllabus is always what to select and what to omit. The suggestion of this article is to select those periods which have left their traces in the neighbourhood, briefly passing over the intervals in which history was being made elsewhere.

To teachers in "new" towns, if there are such in England, this article will not appeal, nor perhaps to teachers in country places. But even in country places the village church, the manor house, the stocks, the local tumulus, the Roman road, or even the sign of the village inn, will furnish valuable object lessons by which the subject may be made of real value and interest, even though they be too few and slight to support the full chain of history.

History Scheme.—Outline of Syllabus.

Visit or Reference to	*Period Illustrated.*	*Subjects of Lessons.*
I. The Name "Oxford." (Ousenaford or Oxnaford ?)	**Prehistoric Times** in England. Celtic Period.	1. The Troglodytes and Celts. 2. The Ancient Britons. 3. Druidism.
II. The Roman Road (from Dorchester to Bicester). (*a*) Beckley.	**The Roman Occupation** of Britain.	4. Roman Conquest. 5. Roman Civilisation in Britain. (including Introduction of Christianity). 6. Fall of Roman Empire.
III. Dorchester Cathedral. (*a*) Founding of Abbeys—*e.g.*, Abingdon and St. Frideswides.	**Saxon Kingdoms.**	7. Hengist and Horsa. 8. Ethelbert and the Monks. 9. Birinus and the Spread of Christianity.
IV. The Castle Mound. (*a*) City fortifications. (*b*) Jewel in Ashmolean Museum.	England under Alfred. **The Danes.**	10. Alfred the Great. 11. The Danes (and Normans).
V. Oxford Castle. (*a*) St. Michael's, Northgate. (*b*) St. Peter-in-the-East. (*c*) St. Peter-le-Bailey. (*d*) Iffley Church.	**Norman Times.**	12. Canute and Edward Confessor. 13. Norman Conquest. 14. Feudal System. 15. Robert d'Oilgi. Osney Abbey. 16. Maud and Stephen. The Barons' War.
VI. Beaumont Palace. (*a*) Woodstock. (*b*) Becket's Window at Christ Church College.	**Plantagenet Kings.**	17. Henry II. and Becket. 18. Richard I. and the Crusades.
VII. Provisions of Oxford. (*a*) Oxfordshire Boroughs. (*b*) Rewley Abbey (stone used to build chapel in St. Mary Magdalene Church). (*c*) Merton College.	Beginnings of Constitutional History.	19. John and Magna Charta. 20. Simon de Montford. 21. "Parliament."
VIII. Town and Gown. (St. Scholasticas Day, 1354–5.) Visit of Mayor and Corporation to St. Mary's Church. (*a*) Carfax Church lowered, 1341, on account of missiles thrown from it at scholars.	Beginnings of Colleges in Oxford. French Wars of Edward III. (*a*) Peasants' Risings. (*b*) Wycliffe.	22. Edward I. and his Wars. 23. The Black Prince. 24. Chivalry. 25. Wat Tyler. 26. Life in Middle Ages—(*a*) Dwellings, (*b*) Food, (*c*) Black Death, (*d*) Society.
IX. All Souls' College. (*a*) Queen's College	French War of Henry V.	27. The House of Lancaster. 28. Agincourt.
X. The Bodleian Library (oldest part). (*a*) Printing in Oxford.	**York and Lancaster.** (War of Roses.)	29. Shadows of the Reformation. 30. The Last of the Barons. 31. Effect of the war on Tudor power. 32. The Princes in the Tower.
XI. Corpus Christi College. (*a*) New Foundations at Oxford.	**The Tudor Period.** (*a*) The Renaissance.	33. Peace and Learning. 34. Columbus and the New World. 35. Movement of Trade to Western Europe.
XII. Christ Church College. (*a*) Wolsey's Statue and Picture.	(*b*) The Reformation.	36. Henry VIII. and Wolsey. 37. Dissolution of Monasteries. 38. Growing Importance of England.
XIII. The Martyrs' Memorial. (*a*) Cross in Broad Street. (*b*) St. Mary's Pulpit.	(*c*) Protestantism and Persecution.	39. "Bloody Mary." 40. Power of Spain. 41. "The Cloister and the Hearth."
XIV. Cumnor Hall and Church. (*a*) Statue of Elizabeth.	(*d*) Expansion under Elizabeth.	42. The Spanish Armada. 43. "The Virgin Queen." Amy Robsart.
XV. The Virgin Porch (St. Mary's). (*a*) Merton College. (*b*) College Plate. (*c*) "Oak Apple Day." (*d*) Milton at Forest Hill.	**The Stewarts.** (*a*) The Great Rebellion.	44. James I. and Union. Divine Right. 45. Charles I. and Civil War. Laud. 46. Cromwell and the Ironsides.
XVI. Addison's Walk. (*a*) Blenheim Palace.	(*b*) The Revolution. (*c*) Party Government. (*d*) Wars of Anne.	47. The Restoration and Papistry. 48. The Act of Settlement. 49. The Coffee Houses and Literature. 50. John Churchill, Duke of Marlborough.
XVII. Nelson at the Sheldonian Theatre.	**House of Hanover.**	51. The French Revolution. 52. Napoleon Bonaparte, "The Little Corporal." 53. Trafalgar and Waterloo.
XVIII. Keble College. XIX. The Coronation of King Edward VII.	The Victorian Era. Present Day.	54. The Oxford Movement. 55 The Boer War.

It is needless to premise that in teaching history on these lines each teacher must make his own individual scheme after a detailed study of the history of his own district. No text-book or article that could be written could cater for the special circumstances of all. But the subjoined scheme, drawn up for use in the writer's school, showing how the history of England may be taught by the study of the historic objects in Oxford, will suggest how a scheme may be drawn up, on the same lines, to meet the circumstances of any other historic place. In this connection it may be remembered that such individuality in schemes and adaptation of teaching to neighbourhoods is strongly urged by the authorities on the Board of Education.

As actual observation is the essential feature of the scheme, the necessary preliminary to the study of each quarter's syllabus is a school walk taken by the boys to inspect and examine the relics of the period with which the syllabus deals. In the first quarter of the current school year the syllabus in the writer's school included early English history, from the earliest times to the Norman Conquest. In the first week of the quarter the boys were taken one morning to inspect the Roman road which runs along a ridge to the east of Oxford, from Dorchester to Bicester. Various boys who had been to these places were asked to point out their approximate situation, the points of the compass were observed (by the sun and local observations), and the road was seen to run nearly due north and south. Rough sketch-maps of the road were drawn in the boys' notebooks. Its undeviating line was noted, and the deduction made that its makers were a determined, resolute people. The fact that it ran plainly through the ploughland, yet was obviously unused, showed the thoroughness of the workmanship, the results of which neither time, nor neglect, nor the ploughs of succeeding generations could destroy. The civilisation of which such engineering skill was the proof was then commented on. Further, the position of the road on the ridge was pointed out, and the boys were led to infer that a wide lookout over the surrounding country could be obtained, and that the height was a vantage ground for those holding it; hence that the road was a *military* one, made by a nation of soldiers. A tumulus, supposed to be British, was next inspected, and the terms Briton and British impressed on the children's memories in connection with it. (The return journey was utilised in making seasonal observations in connection with the nature-study syllabus.) In succeeding weeks at school, lessons were given on the Romans, the Britons, Roman civilisation in Britain and its evidences to-day, early Christianity (St. Alban) and Druidism, the fall of the Roman Empire. In mid-term the boys spent an hour one morning in visiting the city mound, a large hillock commanding a disused channel of the Thames. The absence of stone fortifications was noted, the inference being that the makers of the mound were not builders nor skilled in military works. The construction of a wooden palisade round the hill-top was suggested, and reference made to the Saxon fight at Hastings. The position of the mound, overlooking the river, suggested that enemies were to be expected by that channel, and led up to mention of the Danes, and hence the Normans. Thus attention was easily led to the remaining tower of the neighbouring Norman castle, built by Robert d'Oilgi, the lieutenant of the Conqueror in Oxford. The superior skill (and hence civilisation) of the Norman was thus evidenced. From the high mound several church towers could be seen. The remarkable resemblance which some of them bore to the square castle tower was remarked. Many of the boys knew that these square towered churches were the oldest ones in Oxford. Reference was made to their positions at the gates of the city wall. Their great solidity and the strength of their round arches were seen, and it became obvious that, though churches, they were also intended to be fortresses. Thus the warlike spirit of those times, when churches were embattled and priests were often trained warriors, was realised by the boys as it could not have been by oral or written description alone. The rest of the term's lessons in school dealt with the Saxons and their relations with the Danes and the Normans. Continual references were made to observations taken on the school walk and to other historical places in the neighbourhood—for example, the White Horse Hill in connection with Alfred. The children were also encouraged to make visits of inspection on their own account, and to report anything which they considered relevant, or to ask questions on any building, etc., which they believed was connected with the period.

At the end of the quarter a short visit was paid to the Ashmolean Museum, and relics of the Britons, Romans, and Saxons were inspected, including burial urns, knives, swords, shields, lamps, etc.

Each quarter's syllabus would be treated in the same way. The expeditions made in class with the teacher should aim at showing the children what to look for and how to look for it, so that as the lessons are taken in school the children will be able to make independent observations on their own account. In short, the subject should be taken on the lines of the nature-study lessons.

The great aim of the nature-study schemes which are so much in evidence just now is to train the children in self-help by showing them what it is possible to learn from their own unaided powers of observation; and history, in historic places, may well be taught on the same lines. Thus in "these stones" may be found indeed "sermons."

THE INSPECTOR'S NOTEBOOK.

BY AN INSPECTOR OF SCHOOLS.

I HAVE received so many letters from correspondents asking for my advice as to the various local authority educational secretaryships, etc., which are now thrown open that I propose to devote a few lines to dealing generally with this subject. I apologise to my lady readers before doing so. The educational posts are of at least two distinct types. I leave out of consideration the secondary educational posts. There are the inspectorships and the secretaryships. Occasionally a man is asked for in the double capacity, but that individual will probably do more as secretary than as inspector.

Local Authority Posts.

The secretaryships of the future will be only open to men with actual experience in similar posts. Any young teachers desirous then of aiming at such positions would do well to obtain a clerkship in an education office. That is the readiest road to a future secretaryship. Whilst so engaged the junior clerk might read for a degree, or, better still, qualify as a barrister. Any teacher aiming at an inspectorship should obtain a university

degree, and as varied teaching experience as possible. An Oxford or Cambridge honours degree taken as a resident and whilst attached to a college would be invaluable. Experience in a secondary as well as in an elementary school would stand an applicant in good stead. Secondary education at present looms large on the horizon. The mere elementary man is not much in favour just now. In the many appointments which have been made since the Education Act was passed the secondary school men have easily outpaced the primary teachers. I express no opinions on this matter, and confine myself to hard facts. Culture as evidenced by a non-elementary training seems to be the great *desideratum* of the powers that be.

Any of my readers who require advice on these appointments will oblige me by supplying me with full particulars respecting their ages and qualifications.

THE "NOTEBOOK" QUERY COLUMN.

All communications to be addressed "Inspector," care of Editor, 33 Paternoster Row, E.C., None but very urgent requests will be dealt with by letter. Two stamps for such replies should be enclosed.

D. P. terminated his apprenticeship in December 1903. He qualified under Article 51, in June 1903, by passing a university examination. "Will the school receive a grant, as it would have done had I passed the K.S. Examination? If it will not, am I compelled to pay the grant to the school? If so, to whom am I to pay it? Is the head-master bound to give me my indentures?"

Answer.—No grant will be paid for your success at the university examination. I do not think you are called upon to pay the K.S. grant yourself to anybody. How could you tell how much you would have to pay? £5 for first class, £4 for second class, nothing for third class.

It is certainly usual for the ex-pupil teacher to receive the indentures. You should apply to your managers for them. I am not sure that you have a legal claim to them.

Art. 50 asks:—

1. Having obtained a second class at the last K.S. Examination, can I enter college in September 1905 and take the Certificate Examination in 1906?

2. To what undenominational colleges would the above position probably admit me?

Answer.—1. This position renders you eligible for admission into any college that will take you in September 1905. You could not, however, take the Certificate Examination until July 1907. You would have to spend two years at college. Only certificated teachers and graduates are admitted for one year's training.

2. Bangor (Rev. D. Rowlands, Normal College, Bangor) is the only residential college you could apply to. Any of the day training colleges—for example, Cambridge, Liverpool, London, Oxford, Aberystwith, Leeds, etc.—are open as undenominational colleges.

D. M. says he is head of a large rural school, is a first-class trained certificated teacher, and asks whether it would be of any use for him to write to the Board of Education for an assistant inspectorship. He also desires me to tell him the worth of the L.C.P.

Answer.—I am sorry to tell *D. M.* that there is very little chance of his obtaining a junior inspectorship. The possession of the L.C.P., though undoubtedly a desirable diploma to those unable to graduate at a university, would not increase his chances of a Board of Education appointment. *D. M.* will find further information in my answer to *N. S.* on p. 506 (April number).

X. Y. Z. (1) is a young college-trained teacher in an elementary school who desires to better his position in life. He very wisely writes me at length, so that I have *data* upon which to give him my advice. He suggests three openings—(1) specialist teacher in a higher school, (2) inspectorship at home or abroad, (3) the legal profession—and wishes me to give an opinion on each.

Answer.—*X. Y. Z.* stands very little chance of a government inspectorship. He might, however, eventually procure an inspectorship or secretaryship under a local authority. There will be opportunities shortly in Scotland, after the passing of the Scotch Education Bill. There are also chances in England. The proper thing for him to do is to at once procure a subordinate post in an education office, and so master the routine, and meanwhile read for a degree or qualify as a barrister. Then, if successful, he would obtain a full secretaryship later on. For an inspectorship he should remain as a teacher and take his degree, and then apply for an assistant inspectorship.

As regards the law, I am afraid I can't offer much inducement. Everything depends upon native talent. *X. Y. Z.* could, if in London and if he has money, qualify as a barrister; but unless he has a distinct bent I should not advise him to practise at the bar.

With reference to becoming a specialist teacher, that certainly is the least ambitious scheme and the most likely to succeed. If he is a born teacher, and loves the work, let him take his degree and try special teaching. In any case he should read for a degree. I shall be glad to advise *X. Y. Z.* further if he desires it.

X. Y. Z. (2) desires me to tell him the value of the Welsh B.A. for teaching purposes. He would like to know what salary an Int. B.A. might expect in a secondary school. *X. Y. Z.* also asks for information relative to the duties of a director under a local authority.

Answer.—I have no means of exactly measuring the relative values of the various degrees. Speaking generally, however, a residential degree stands above a non-residential, and an honours degree above a pass. For teaching purposes I do not think that a pass degree would take one very far in secondary work. Probably you could obtain an assistantship in an intermediate school, and subsequently, if successful, a headship. Previous training as a scholar or junior master in a secondary school would count. The varied work I referred to meant actual teaching experience in elementary and secondary schools. Yes, a man with the Welsh B.A. and London B.Sc. together, with good actual experience in teaching, ought to stand well for an assistant directorship or for the headship of a small secondary school. About £100 a year.

G. E. A. passed the London Matriculation Examination first class in June 1903. Can he sit for the Certificate Examination in 1905? Will the fact that he took the K.S. Examination in December 1903 affect the matter at all?

Answer.—He can sit in 1905.

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Parallelograms.

Theorem 21. The opposite sides and angles of a parallelogram are equal, each diagonal bisects the parallelogram, and the diagonals bisect one another.

Given a parallelogram ABCD (Fig. 17).

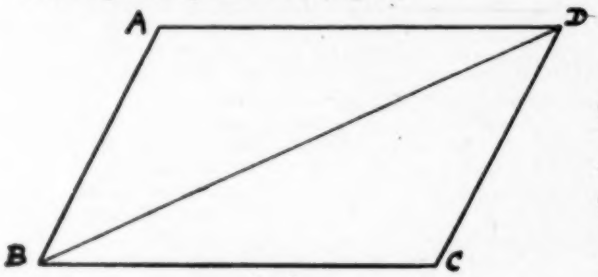


Fig. 17.

To prove—

(i.) The side AD = side BC, and side AB = side CD.

(ii.) ∠ABC = ∠ADC, and ∠BAC = ∠BCD.

(iii.) △ ABD = △ BCD = half ABCD.

Join BD.

Proof: In △s ABD, DBC,
∠ABD = ∠BDC (Theor. 6),
∠ADB = ∠DBC (Theor. 6),
BD is common.
∴ △s are congruent (Theor. 11).
That is, AD = BC, and AB = CD.
∠BAC = ∠BCD.

Also ∠s ABD and DBC = ∠s BDC and ABD (Theor. 6).
That is, ∠ABC = ∠ADC,
and △ ABD = △ BCD = half the parallelogram.

(iv.) To prove the diagonals bisect each other, join AC, cutting BD in O (Fig. 17*a*).

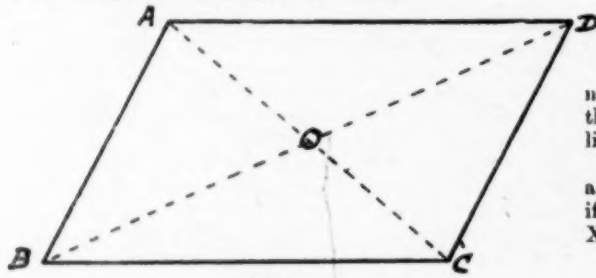


Fig. 17*a*.

Proof: In △s BOC, AOD,
AD = BC (proved above),
∠ADO = ∠OBC (Theor. 6),
∠OAD = ∠OCB (Theor. 6).
∴ △s are congruent (Theor. 11).
That is, AO = OC,
and BO = OD. *Q.E.D.*

Cor. 1. If a parallelogram has one right angle, all its angles are right angles.

Cor. 2. If one pair of adjacent sides of a parallelogram are equal, the figure is equilateral.

Theorem 22. A quadrilateral is a parallelogram if—

(i.) One pair of opposite sides are equal and parallel; or,

(ii.) Both pairs of opposite sides are equal; or,

(iii.) Both pairs of opposite angles are equal; or,

(iv.) The diagonals bisect one another.

Given a quadrilateral ABCD, with

(i.) AD and BC equal and parallel (Fig. 18).

To prove ABCD is a parallelogram.

Proof: Join BD.
In △s ADB, DBC,
AD = BC,
DB is common,
∠ADB = ∠DBC.
∴ △s are congruent (Theor. 10).
That is, ∠ABD = ∠BDC.
∴ AB || CD (Theor. 5),
and ABCD is a parallelogram (Defn.).

(ii.) Given AD = BC and AB = DC.

Proof: △s ABD and DBC are congruent (Theor. 14).
That is, ∠ABD = ∠BDC.
∴ AB || DC (Theor. 5).
Also AB = DC.
∴ AD || BC (proved in i.).
That is, ABCD is a parallelogram (Defn.).

(iii.) Given ∠BAD = ∠BCD and ∠ABC = ∠ADC.

Proof: ∠s BAD and ADC = ∠s DCB and CBA

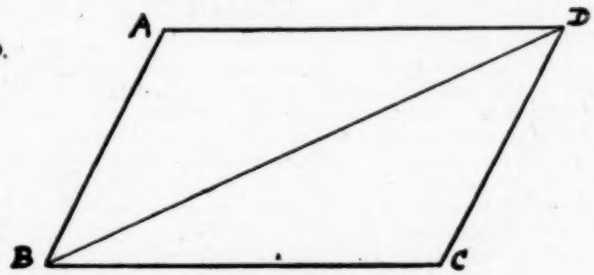


Fig. 18.

= half the angles of the quadrilateral
= 2 rt. ∠s (since ∠s of fig. = 4 rt. ∠s. Theor. 8).
∴ AB || DC (Theor. 5),
and AD || BC (proved in i.).

(iv.) Given AO = OC and BO = OD (Fig. 17*a*).

Proof: △s AOD and BOC are congruent (Theor. 10).
∴ as above, ABCD is a parallelogram. *Q.E.D.*

Theorem 23. If three or more parallel straight lines make equal intercepts on a straight line that cuts them, they will make equal intercepts on every other straight line that cuts them.

Given AB, CD, EF parallel straight lines, and PQR a straight line cutting them so that PQ = QR. Then, if XYZ is another straight line cutting the parallels, XY = YZ (Fig. 19).

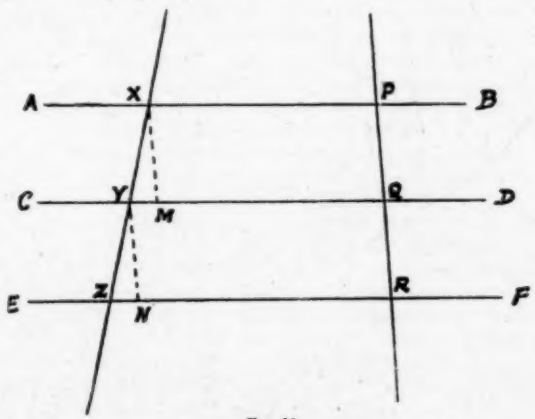


Fig. 19.

Construction: Draw XM, YN || to PQR, to meet CD and EF in M and N.

Proof: XM = PQ, and YN = QR (Theor. 21).

∴ XM = YN.

Now, in △s XMY, YNZ,

XM = YN,

∠XYM = ∠YZN (corresponding ∠s),

∠YXM = ∠ZYN. ∵ XM || YN.

∴ △s are congruent (Theor. 11).

That is, XY = YZ. *Q.E.D.*

Cor. 1. If a straight line be drawn through the middle point of one side of a △, || to the base, it will bisect the other side.

Cor. 2. The straight line joining the middle points of two sides of a △ is || to the third side.

Construction: Problem 7. To divide a straight line into any number of equal parts.

Given a straight line AB. To divide it into six equal parts.

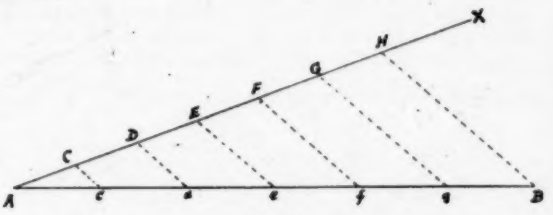


FIG. 20.

Construction: Draw any line AX, making an acute angle with AB.

From AX cut off any part AC, and mark off six parts along AX equal to AC so that AH = six times AC.

Join BH, and through C, D, E, F, G draw parallels to BH, cutting AB in *c*, *d*, *e*, *f*, *g*.

Then AB is divided into six equal parts.

Proof: Theorem 23. *Q.E.F.*

Revision Exercises on Section I.

1. ABCD is a quadrilateral, and the diagonal AC bisects the angles at A and C. Show that AC is at right angles to the other diagonal BD. (*B.E.*)

2. If a triangle ABC be turned over about its side AB, show that the line joining the two positions of C is perpendicular to AB. (*K.S.*)

3. Two straight lines AB and CD bisect one another. Show that the straight lines joining AD and BC are parallel. (*B.E.*)

4. If a quadrilateral has its opposite sides equal, show that its opposite angles are equal. (*L.U.M.*)

5. Two equal straight lines AB and CD are joined towards opposite parts by the equal straight lines AD and BC intersecting in O. Prove that the triangles OAC and OBD are isosceles. (*L.U.M.*)

6. An equilateral triangle and an isosceles triangle are upon the same base. Show that the line joining their vertices (produced if necessary) bisects the base at right angles. (*B.E.*)

7. Prove by considering the rotation of a line, or in any other manner, that the sum of the angles of a triangle is invariable. (*L.U.M.*)

8. Two angles of a triangle are 40° and 120° respectively. Show that the triangle may be divided into two isosceles triangles in two different ways. (*L.U.M.*)

9. Show that the sum of the distances of any point from the angular points of a closed polygon is greater than half the perimeter of the polygon. (*L.U.M.*)

10. If T be the middle point of the diagonal QS of a quadrilateral PQRS whose opposite sides are equal, then P, T, R are in a straight line. (*K.S.*)

11. ABC is a triangle having an acute angle at B, which is greater than the angle at A; the side AB is produced to D, and BE is drawn to meet AC produced in E in such a way that the angle DBE is equal to the angle ABC. Show that BE is longer than BC. (*B.E.*)

12. If the straight line which bisects the exterior angle of a triangle is parallel to the base, the triangle is isosceles. (*K.S.*)

13. In a given line a point A is taken, and B is a point outside the line. Find a point in the line equidistant from A and B. Can such a point always be found? (*L.U.M.*)

14. Describe the properties possessed by the diagonals of (i.) a square, (ii.) a rectangle, (iii.) a rhombus. (*L.U.M.*)

15. If P and Q be two points on one side of a straight line AB such that the perps. drawn from them to AB are equal, then PQ is parallel to AB. (*L.U.M.*)

16. Show that the angle contained by the bisector of the vertical angle of a triangle and the perp. from the vertex to the base is equal to half the difference of the angles at the base. (*K.S.*)

17. Show that the greater diagonal of a parallelogram passes through the smaller angles. (*B.E.*)

18. A, B, and C are three given points. Through A draw a line such that the perps. upon it from B and C may be equal. (*K.S.*)

19. From a given straight line cut off a part equal to $\frac{3}{7}$ of the whole.

20. Given the middle points of three sides of a triangle, construct it. Prove your construction.

References—L.U.M. London University Matriculation.
B.E. Board of Education, Secondary Branch.
K.S. King's Scholarship.

OUR ILLUSTRATED GEOGRAPHICAL NOTEBOOK.

THE WORLD'S CABLE AND TELEGRAPH LINES.

TO bridge space by the communication of thought was a dream of even the ancients, and it has been surmised that the tower of Babel was chiefly intended as a huge signalling station. Columns of fire and smoke were used to guide the Israelites after their flight from Egypt; which system finds its parallel in the smoke signals of some savage peoples to this day. Hannibal transmitted messages by signals from towers which he erected in Asia and Spain, and Trajan's Column bears a representation of a Roman telegraphic station. Along the Great Wall of China were fire signals that would in a very short time arouse the whole frontier to rise against some threatened danger; and in our own country beacon fires have blazed out similar warnings in time of national peril.

In 1663 the Marquis of Worcester published his *Century of Inventions*, in which he proposed "how at a window, as far as the eye can discover black from white, a man may hold discourse with his correspondent without noise made or notice taken," together with "a way to do it by night as well as by day, though as dark as pitch is black."

As the sciences of optics and acoustics became better known, still further attempts were made to establish

a reliable system of telegraphy; and that a large measure of success was attained is proved by the fact that some of these visual and aerial telegraph systems have not been entirely abandoned. For military purposes the heliograph is invaluable in the field, where the apparatus, by means of mirrors, flashes a beam of light in accordance with a signal code over a distance of many miles. In the navy, flags of various forms and colours have long been used for signalling messages from vessel to vessel; and on our railways, signals by day and night are very effective.

The Electric Telegraph.—The history of the development of the art of telegraphy by means of galvanism and electro-magnetism is extremely interesting, but within the scope of this present article it will be possible to present only the merest outlines of the experiments that led to ultimate success.

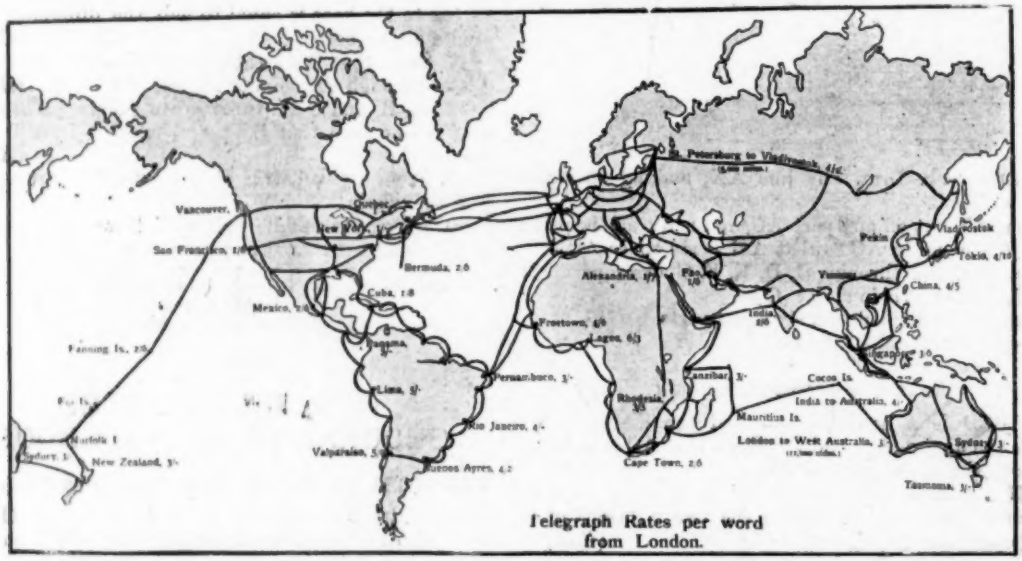
There appears to be no doubt that Baron Schilling, an officer in the Russian army, was the first to construct an electro-magnetic telegraph. He was attached to the embassy at Munich, where he became interested in an apparatus invented by Dr. Sœmmering at the Academy of Sciences. Schilling had no other idea than to devise some means of facilitating military operations by rapid transmission of messages or the firing of mines across streams. In 1812 he fired several mines across the Neva at St. Petersburg, and it is remarkable that his method involved the ignition of two pieces of carbon cut to a point. During the next few years came the discovery that a galvanic current would cause a magnetised needle to undergo a deviation. Schilling seized upon the idea, and after patient investigation produced an apparatus which he exhibited before a meeting of German scientists at Bonn in September 1820.

This brought about the introduction of this telegraph to London by William Cooke, a student of anatomy at Heidelberg University. In 1836 Cooke saw a model of Schilling's apparatus, and thereupon determined to devote all his energies to the construction of a telegraph that would be useful in railway work, especially in tunnels. Cooke consulted Faraday, and later entered into partnership with Professor Wheatstone, who improved Schilling's apparatus in several important particulars, the introduction of the vertical needle being the most notable.

The name of Professor Morse of New York is often unduly associated with the success of electro-magnetic telegraphy. In 1832 he claimed to be the inventor of the "first really practical telegraph founded on electrical principles." Morse was evidently ignorant of Schilling's operations some twelve years earlier, or he would never have advanced his claim.

The year 1839 saw the first electric telegraph line in England, between Paddington and West Drayton on the Great Western Railway; in 1840 the Blackwall Railway adopted it; and a year later it was in use on the Glasgow and Edinburgh line. In 1843 the Great Western Co. extended their telegraph to Slough, but it was not until two years later that the arrest of a murderer by means of the telegraph forcibly attracted public attention to the potent possibilities of the telegraph. By this time all civilised nations were alive to the value of the new means of communication, and were busy laying down experimental lines.

Submarine Cables.—Schilling's submerged conductors for exploding mines may be accepted as the genesis of the submarine cable. As early as 1837 Wheatstone was devoting attention to the possibility of a submarine telegraph between Dover and Calais; and Professor Morse, in 1842, claimed in the harbour of New York to have proved the possibility of a submarine telegraph across the Atlantic. In England various persons were conducting experiments, in one of which Sir Joseph Paxton, the architect of the Crystal Palace, and Charles Dickens were interested. Eventually to John Brett fell the credit of perfecting and carrying out the conception of others. In August 1850 France and England were connected, communication was established, and a message was dispatched to Louis Napoleon. Though during the night the insulation was broken, the experiment had proved so indubitably successful that a stronger cable was at once commenced. Twelve months later the new cable was laid; and although it has been repaired, and in parts renewed, since that time, the cable has been in use ever since.



Telegraph Rates per word from London.

The Atlantic Cable.—"Two yearning worlds made

one with lightning spark." The first attempt to connect the Old and New Worlds by means of the electric telegraph was made in 1857, when the cable gave way owing to the sudden dip in the Irish bank, which caused a strain that the laying apparatus was unable to withstand. After a year had elapsed the cable was successfully laid, and messages were exchanged between Queen Victoria and the President of the United States. After a few days, however, the transmitting power weakened and gradually ceased. Seven years passed before another attempt was made, and again the result was failure. On July 27, 1866, a new cable was laid, and a great work, fraught with untold possibilities for civilisation, law, and liberty throughout the world, was successfully accomplished.

The commercial success of the venture was assured from the very first. In fifty-five days, from 28th July to 21st September, the cable earned £46,048; excluding exceptional days, when land stoppages interfered, the earnings averaged £960 per day. Nowadays more than a dozen cables lie between Valentia Island and Trinity Bay, Newfoundland.

Cable Development.—At the present time the world's cables are estimated to be :—

	Cables.	Nautical Miles.
Owned by nations.....	1,287	32,880
Owned by companies	432	180,013
	1,719	212,893

The total cost is calculated to be £55,000,000. More than half of them are British, and British capital invested amounts to over £30,000,000. No less than 40 cables touch Great Britain. Other nations are laying cables in all directions. Germany in seven years has laid 7,370 miles, at a cost of 1¼ millions. The length of lines is more difficult to estimate, but there are quite 700,000 miles constructed, at a cost of about £70,000,000.

The All-British Cable.—First mooted in 1879 by Sir Sandford Fleming, the chief engineer of the Canadian Pacific Railway, it was not until October 31, 1902, that the All-British cable became an accomplished fact. On this date was opened a new cable, 7,800 miles in length, connecting Vancouver and Australia *vid* Fanning Island, Fiji Islands, and Norfolk Island. From Vancouver to Fanning Island is 3,445 nautical miles. This section is the longest ever laid, and its completion in seventeen days created a record in cable laying. The total cost of the Pacific cable was about £2,000,000, which was borne by Great Britain, Canada, and Australia. This latest outcome of patriotism and persistence has enormously reduced the cost of messages between distant parts of the empire. Ten years ago it cost 10s. 4d. per word to cable from Canada to Australia; now it is but 3s. 2d. from Vancouver to Norfolk Island; and experts assert it will yet be possible to transmit messages between London and Vancouver at 3d. or 4d. per word, and to Australia for about twice as much. Whether an All-British cable was altogether a wise project is certainly open to argument. Its opponents claim that it were better for some of the cable stations, at least, to be upon non-British territory, so that in time of war neutral interests might have weight when the question of cutting cables was under consideration by the enemy. On the other hand, it is urged that Great Britain has a preponderating interest in the world's cables. All the ends of the world are practically centred in London, and news from any part of the globe can scarcely hope to reach Europe except *vid* some of the strands of Britain's network of cables. During the Spanish-American War the United States found it practically impossible to cut off the telegraphic communications of Cuba; how, then, would it be possible to isolate Great Britain, with innumerable strings to her bow? Commercially the All-British cable seems undoubtedly justified. What may possibly happen to it in time of war need not seriously militate against the interests of the empire.

Wireless Telegraphy.—No article dealing with the electric telegraph would be complete without a reference to wireless telegraphy. There are at least a dozen systems undergoing trial and experiment in different parts of the world, but the inventor who stands out conspicuously above all others is Marconi. His apparatus has transmitted messages 3,000 miles across the Atlantic; ships 50 and 100 miles apart exchange messages with comparative ease; and the British Admiralty has practically adopted the system for all ships in the navy—a course that has been followed by many of the leading steamship companies.

Wireless telegraphy presents problems, such as confusion and interception of messages, that scientists are yet unable to satisfactorily overcome. There is little likelihood of the system superseding ordinary telegraphic methods. The wireless system is slow, the greatest speed being fifteen words per minute over short distances, and a third of that number over long distances, whereas a message can be cabled round the world in thirty minutes. There is, however, great scope for wireless communication between vessels at sea and between ships in distress and the adjacent coast; and if the system accomplishes no more than this, it will be a welcome addition to the facilities that aid our world wide commerce.

A RECENT INSPECTION.

(Second Visit.)

AN H. M. Inspector has but lately been appointed to this district, and as he entered and made his way to me I knew him not. The black bag he carried suggested to me that he was a publisher's traveller, one of those missionaries of light who come and show you the "latest thing and the best," but his manner was of quite a different sort. "No hurry, madam," of the traveller was changed into "Good-morning! I am His Majesty's Inspector. I suppose you are the mistress."

I had to confess it truly, and we were soon on good terms.

"I see the children are already at work. Suppose we look at what you have to show. Back work, you know, I mean," said he. And his manner indicated, as I thought, curtness which might possibly develop into dissatisfaction. How one *can* change!

I had hardly resolved what to show him first. The best, I thought, to humour him and set myself at ease; but before I could suggest paper-work, he had asked for the sewing.

"By-the-bye," continued he, in a drawl, looking about him the while, "while I examine the needlework, which I see you have perfectly handy—and that is very nice—suppose the children of the standard class—you have a standard, I suppose—suppose the children of the standard class are set to work on arithmetic. I scribbled out these sums while I was in the train, and they ought to suit—nicely. Too hard? No? Very good."

Taking from him the half-sheet of notepaper which he held towards me, I moved and unfolded a few of my needlework specimens. These were just the things to keep him busy for a time. I should have an opportunity of seeing that the sums—all problems—were well understood by the children to whom they would be dictated.

"Who takes the standard?" asked he.

"I take it myself," I replied.

"Very good. Perhaps you will just see that no time is wasted. I am here for two hours only this morning, and I want to put in full-time work."

"I will see that everything is done expeditiously," returned I; but to myself I muttered, "but I'm not going to have any one over-hurried. The children will become bewildered, the teachers will lose their heads, and everything will go wrong."

Reading the sums over to myself as I walked across, or rather along, the room to the senior children—I like to look at them as seniors even though they are so tiny—I felt assured they would be done in double-quick time. They were ridiculously easy. "Ah!" thought I a moment afterwards, "maybe they are so easy that they will confuse the children. I don't ever remember setting one like this or like that. Dear, dear, what is to be done?"

Under such circumstances as these it is always best to *hope* for the best.

The inspector watched me as I walked slowly away, and by the time I had prepared the children and given out his first problem he had come over to me.

"I see you are helping the children," said he, rather playfully. "I think I would prefer you to leave all to the children themselves. I have made the sums easy, as you yourself have acknowledged, and—please, leave them to the children."

What had I done? Mr. Editor, you are to blame, if blame there be, for I learnt it from your own columns; and a right good help I have always found it to be.

It was merely this. A + had been put at the side of the last number I had dictated, for the purpose of reminding the children that the sum was one in *addition*. I had merely said to the children, "Now, children, think of the story of the sum"—I always call problems story-sums—"and when you have made up your minds what the sum is, make your mark." This, as I have said, they had done. I pointed out to the inspector that four sums, all problems, were a lot for little minds to remember; and that as the × and ÷ signs were always allowed in the two higher rules, I saw no reason why signs should not be used in addition and subtraction. I gained my point, and in all the sums the signs were allowed. The following was the test:—

1. A boy went to a shop and bought 20 marbles, to another and bought 30, to another and bought 40, and to another and bought 50. He counted them one by one into a bag. How many did he count?

2. Harry has 80 apples in a basket. Twenty of them drop through a hole in the bottom. How many are left?

3. Divide 60 toys equally between 5 children, and tell me how many each will have.

4. Multiply 30 by 3; then tell me how many more you would want to make up a hundred.

I thought all these noughts over in my mind, and wondered how the children would deal with them. In the first sum only twelve children had the answer positively correct, nineteen had a dot under the noughts and the tens added up correctly, and most of the remaining children had added the tens only, and had utterly ignored the units. This is what I thought they would all do, for I do not remember ever having set for them a sum where noughts and nothing else came in the units. So much for my lack of ingenuity in sum-setting. The inspector accepted 14 · as the correct answer, as it could be seen that the children had counted the noughts as nothing. At the same time, he pointed out that 14 · and 140 were two totally different numbers. Of course, I agreed. But the moral of it all is: Set noughts sometimes in the units, and so accustom the children to *catch* sums. It is a good thing for me, perhaps, that the other sums were done better than usual; for I understand, though he did not say so in words, that the inspector was satisfied with the result. As it was much below my own standard of excellence, and also below that usually obtained, I myself was much annoyed. I have learned something, however, and I live to learn as well as to teach.

The writing of all the children was looked into very carefully. The slant and slope of the letters, the junctions, the spaces between the words, and the regularity of the writing as a whole were the pegs on which the examination hung. Here and there a child was asked to read what had been written. By a curious mistake, one of the children had happened to spell the word *gone* wrongly, by writing *j* instead of *g*. He had to pass between "the grinding stones" in consequence. The following words were written for him—*again*, *get*, *gave*, *goose*, *wag*, and one or two more which I have forgotten; and he was asked to alter the *g* into *j* in each case, pronounce the new word formed, and confess that he had made a very silly mistake. I don't suppose, however, that he himself felt he had done much wrong, for during the rest of the morning I noticed that he was more than usually playful.

A saunter back to the sewing-basket and an examination of the things it contained resulted in a very pleasant chat on the children's eyesight and their general strength and constitution. The inspector seemed to use his own eyes with a remarkable result. He could see unblacked boots when *I* thought he was looking at stitches; could see pencils held wrong when *I* thought he was going to compliment me on the cleanness and regularity of the hems; could see children bending down on the desks too close to their work when *I* thought he was pleased at the variety of the little garments we had made. The unfinished pieces of work he spent all his attention upon; the way the needles were left and the class hearth-rug we are making were things upon which he had a remark of some kind to pass. We made a small profit on the needlework of last year, and on hearing this he wanted to know how the money went. Did I return it to the managers, or how did it go? For reply I sent for several of my museum specimens, and showed him how short I should sometimes find myself in object-lesson illustrations if I did not make a few shillings in some way out of the needlework. I showed him my accounts, and I am certain I got a good mark for book-keeping.

This suggested registers, and as the children were now on their way to the playground—I was glad the morning was a bright one—he asked to see them. I seemed to be earning good marks all round, for he favourably commented on their neatness and clean appearance. I do them all myself, and perhaps that is the reason. He said nothing, however, nor did he

afterwards check the numbers. I wish he had, for I am sure they were correct.

Object Teaching.—The arrangements for a lesson on chalk had been made during the recess, and the teacher on commencing the lesson pleased the inspector at the very first by asking, "What is the lesson to be about this morning?" He thought it was a capital idea that the children should grow accustomed to know beforehand the subject of the lesson.

"It can be talked about at home," said he; "and what we want up and down this land is that school affairs should be talked over at the breakfast or dinner table. Interest the parents, and you have won their sympathy and their help." The comparisons made by the teacher between various minerals also pleased him, and so did her plan of setting the children, as far as possible, to work. The specimens in use were—a piece of rock salt, a piece of quartz crystal, a glass of water, a piece of whiting, and chalk. The children were asked for differences between the crystals, the chalk, and the salt, and on some of them not knowing any, they were told to do something to find out. Coming to the front, a little girl took out her thimble, and tried to scratch the crystal. No result, after very close examination. Then she tried to scratch the salt. Yes, easily; then the chalk—yes. Clearly two were alike and one different. Now a boy came and tried to find other properties alike or different. The crystal in water. Looking and tasting he found no result. Salt in water. Yes—discoloration (a little, on account of the earth mixed up with it) of the water, and also a bitter taste. Now chalk in water. Discoloration at once, but this time clearly the result of something which the chalk itself has to do with the water.

And so similarities and differences were found out. About the chalk itself, of course, many things were learnt. The inspector was pleased with the way in which a child found out whether or not it was porous. We sometimes don't realise how much our reputations are in the hands of our little ones, and when a child is found to do something worth doing in the presence of an inspector, who can give or take away, we bless him for his common sense. A boy was asked to find out whether the chalk was porous. He came up smiling. Of course he could. He lifted down the pot of red ink from the teacher's desk, and having dipped a long piece of chalk in it, he anxiously awaited the result. After watching the red colour rise up the chalk, he turned to the inspector and said, "Yes, sir."

"Good boy," replied he. "Now try the quartz crystal, as you call it."

Seeing the boy hesitate as to how it should be done, as he had no vessel near which was large enough to hold it, the inspector *asked* him what he proposed to do. He was fairly ready, but was convinced that the quartz was not porous. He would fetch a bucketful of water, but it would be of no use, he was sure.

When this was over the inspector, glancing round the room, saw a cocoa-nut in all its natural state on a bracket on the wall. He asked that it might be taken down, and the children put through a lesson which would show him whether the various specimens he could see about the room were for use or for ornament only. This was done, and the teacher (a P.T.) who had given the lesson some time ago was brought to conduct the conversation. Seeing the children sitting as though waiting for her, she came to me and asked whether they had been sitting for a long or a short time. I thought she was a very sensible girl, for I knew what was in her mind. Had they been sitting long, she would have put them through an exercise or two first. The inspector, however, wanted to know why she didn't begin; but when he had been told, he was more pleased than I should have imagined. The teacher showed by her course of questions and suggestions for conversation what points she had brought up in her previous lesson, and the inspector gave her an encouraging word for her success, and congratulated me for my manner of training.

Throughout the morning—that is, as long as he stayed—he showed no signs of wanting to find out a cause for complaint, with the exception of that point in the arithmetic lesson, and which I scored from. Fault-finding seemed to be entirely foreign to him. He made an honest endeavour to estimate the true value of the teaching and the training of the children. What he found good, whether he knew of the special plan or not, he congratulated me upon; and what ill, in his opinion, he argued over. He did not, however, condemn at first sight, as I have known inspectors do. He asked me, and politely, too, to try some other way, and let him know the result. He is a sensible man, and I like him for his candour and straightforwardness. He showed a sympathetic spirit, too, and he even commiserated with the sickly fuchsia and the withered geraniums, which were patiently awaiting the warmth of the spring. These were standing on a window-ledge, and I gather he likes to see plants and flowers in the school. Certainly a plate containing a moistened flannel on which some mustard seeds and some peas and beans were set to sprout drew his attention. There were some seed-cases lying about on the flannel, and he lifted the plate down, and showing them to a little girl, asked her what they were.

We do a great deal of blackboard drawing for the purpose of illustrating the object lessons, and these also came in for a word of commendation. He favours the rough-and-ready drawing, and thinks a drawing done in the presence of a child of more value than one done in his absence, no matter how much labour and care may be lavished upon it.

"Let the children see you do it," said he, with an accent on *see*. "They will be all the more likely to remember it, and imitate it too."

With this I quite agree.

THE NEW MODEL COURSE OF PHYSICAL EXERCISES.

THE Report of the Inter-Departmental Committee on the Model Course has now been issued, and is well worth reading by those interested in the physical welfare of the young—especially, perhaps, the "Report" and "Introduction."

There can be little doubt that this is at last a serious attempt to amalgamate all that is best in known methods of elementary physical training, and the chairman's name is a sure guarantee of sound and practical work.

The terms of reference to the committee were:—

"To examine the Model Course now in use, to judge how far it should be modified or supplemented, and to consider what principles should be followed in order to render a Model Course, or Courses, adaptable

for the different ages and sexes of the children in public elementary schools."

The committee having carefully examined the existing model course, "do not consider (it).....to be a suitable course for use in schools.....in part because certain .....exercises.....seem unsuitable as elements of a compulsory course.....chiefly because the course as a whole does not seem constructed on well-defined general principles," etc.

The committee therefore did not (and rightly) consider it possible to alter or amend the model course, but set seriously to work to discover "the purpose of such exercise in schools, and the general principles on which a school course should be constructed."

It is noticeable that the committee do not claim to have invented a scheme or system of exercises—as do so many at the present day, in nearly every case unwarrantably, by the way—but merely claim to have selected from other sources the exercises most suited to children of school age (presumably five to fourteen).

For these children the use of special apparatus is considered unnecessary, though nothing is said against the use of dumb-bells, barbells, etc. No exercises are included which could possibly harm children of even weak physique, neither are there any "purely ornamental exercises."

The committee do not wish the exercises to be confined to those given in the syllabus. On the contrary, they desire teachers to, in a large measure, use their own discretion, provided that correct principles are always observed, and that there is a reasonable prospect of beneficial effect.

But such alterations should not be made lightly, and in fact it is suggested that "regular means should be provided" for revision of or addition to the syllabus, and such alterations as have stood the test of time and experience should be "formally incorporated in any revised edition of the syllabus."

It is realised that there must be many children who ought to be partially or even wholly excused from these physical exercises; and while it is felt that the more experienced teacher might be left to make the selection of such children on his or her own responsibility, it is suggested that future teachers should receive suitable instruction in hygiene, and in the outward signs of mental and physical weakness.

This instruction should not be of the "mere book-work" description, but should, if possible, include "clinical experience." In short, they should have practical experience of many of those forms of investigation which are grouped under the heading of "child-study."

The committee believe that teachers who are in possession of some diploma for giving instruction in physical exercises will easily adapt themselves to the present scheme without special instruction, but they also think that "abundant opportunities should be provided" whereby "existing" teachers—and it may be supposed the teachers to be—may qualify themselves in this course, and, further, obtain a wider knowledge of hygiene and child-study.

[With regard to this, it is probable that, in the near future, a National Institute *may* be formed, with the principal object of (*a*) giving instruction, and (*b*) granting diplomas to teachers which shall fully qualify them in any part of the kingdom.]

It is further emphasised that, although the class teacher gives the instruction in physical education to his class, the professional or "specialist" teacher of physical training is still necessary.

"Local authorities will always find it expedient to have at their disposal.....teachers who have made a special study of.....physical training, and to entrust them with large duties of organisation and supervision."

Here, too, it is suggested that some means must be provided for testing and certifying candidates for such posts, and it is hoped that the National Institute before suggested may supply such a want.

The introduction to the syllabus of exercises is an excellent exposition of the aims and effects of physical education; it includes carefully-written paragraphs under such headings as, "Physical Effects," "Recreation Exercises," "Constitutional Weakness," "Breathlessness," "Music with Exercises," "Fresh Air during Exercise," "Directions to Teachers," etc., at the conclusion of which the following sentence occurs:—

"Finally, there is no part of school work in which the spirit and intention of the teacher are so clearly reflected in the performance of the children as in physical exercise."

Now, with regard to the actual system, or movements to be performed, they are practically the elements of Ling's Swedish system, somewhat anglicised or "smartened."

Commencing with a few necessary though elementary military movements, or "class arrangements" as they are called, we come to the "starting positions;" and here it will be found that the words of command differ somewhat from those generally in use. For example, the old command, "Hands on hips," is supplanted by "Hips firm." It is a question which is the better word of command. The former is preferred by military instructors as being sharper in its executive part. Then, too, the command, "Feet close," is given, instead of as formerly, "Toes in;" and so on throughout the course.

It may be said at once that there is nothing new in the whole book; but the work is decidedly systematic as far as it goes, and is strictly in accord with the general principles laid down in the Introduction.

In the more advanced and complicated movements there is a tendency to redundancy in the cautionary and executive words of command—for example, 66: "Forward lunging. Arms forward and sideways swinging; arms forward and upward; raise, with arms swinging; left foot forward—LUNGE." This tremendous mouthful appears to be necessary for the performance of one very simple movement; and even when the class is able to perform the exercise "judging the time," it would still appear necessary to repeat the whole of the cautionary part of the command, which is a waste of time. Let such combinations be called first, second, etc., exercises.

To sum up. The new model course puts physical training on a sound basis, raising it to the level of other branches of education; it shows clearly the necessity for organisation and supervision, and for the correct teaching and a thorough knowledge of the whole subject. It gives us at last one common system, if not perfect and complete, at all events simple and sensible, and, whilst easy enough for the weakest scholars, can be made difficult enough for the strongest lad.

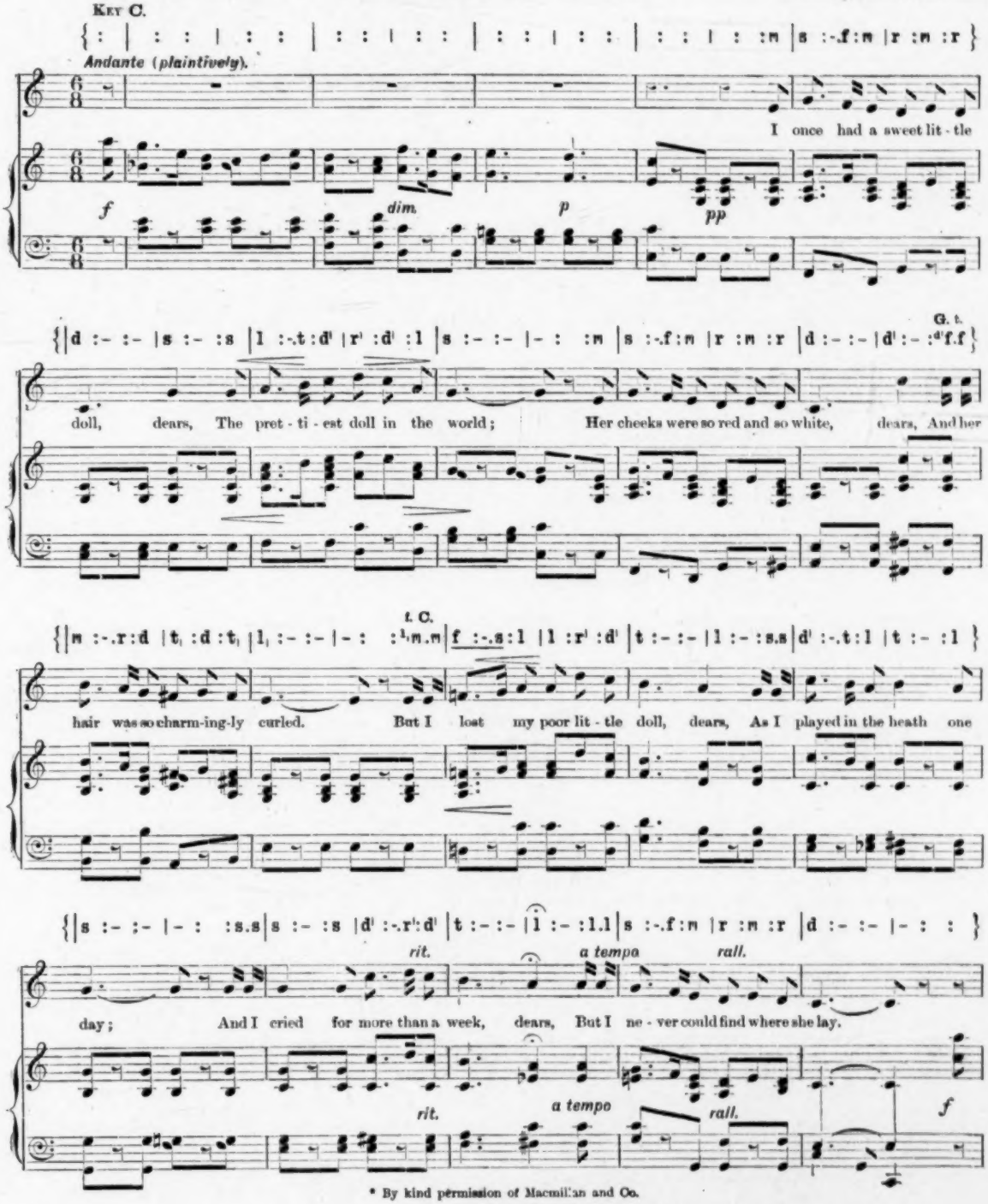
In future, teachers need not worry themselves as to whose system they shall take up; they have here, for the cost of a sixpence, a sound elementary course, which, it is rightly intended, shall gradually become universal—truly a national system.

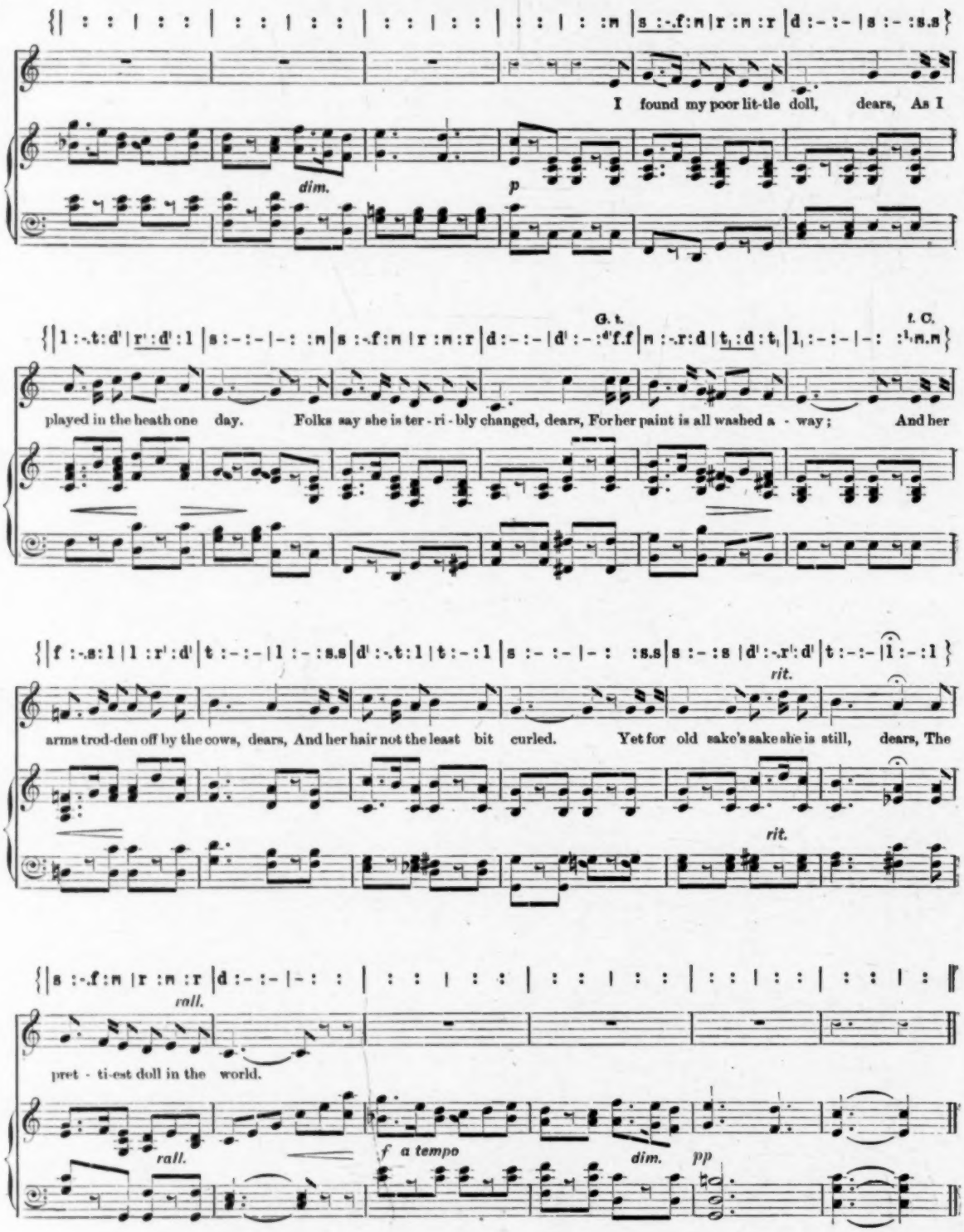
The Practical
Infant-School Teacher.

* Poetry from the "Water Babies," by CHAS. KINGSLEY.

"MY LITTLE DOLL."

Music by, THOS. J. HEWITT.

KEY C.

Andante (plaintively).
I once had a sweet lit - tle
doll, dears, The pret - ti - est doll in the world; Her cheeks were so red and so white, dears, And her
hair was so charm-ing-ly curled. But I lost my poor lit - tle doll, dears, As I played in the heath one
day; And I cried for more than a week, dears, But I ne - ver could find where she lay.
dim.
rit.
a tempo
rall.

* By kind permission of Macmillan and Co.

I found my poor lit-tle doll, dears, As I
dim.
p
played in the heath one day. Folks say she is ter - ri - bly changed, dears, For her paint is all washed a - way; And her
G. t.
t. C.
arms trod-den off by the cows, dears, And her hair not the least bit curled. Yet for old sake's sake she is still, dears, The
rit.
rit.
pret - ti-est doll in the world.
rall.
rall.
f a tempo
dim.
pp

THE GENESIS AND LORE OF THE FAIRY TALE.

BY J. EDWARD PARROTT, M.A., LL.D.

(*Continued from p. 575.*)

I HAVE already hinted that fairy tales are a fit study for the energies of grown men and women, and that folk-lore is worthy to be dignified with the honorific epithet of science. Turning to the stories contained in such a dainty collection as that of Mr. Andrew Lang's polychrome fairy books, we at once perceive how elastic and comprehensive the term "fairy tale" is. We find many fairy tales without fairies; some without any supernatural element at all. Other tales turn on the baleful potency of witchcraft or the extreme terror excited by man-eating ogres and giants, whose gross bodies are united with such extremely stupid minds that they are easily overthrown by a puny mortal with a fair share of cunning and resource.

The science of folk-lore sweeps into its wide net every old-time custom, usage, observance, legend, myth, tale, song, and superstition which has an ancient and undoubted pedigree. These things are the learning of yesterday, and they have become the lore of to-day. A full knowledge of the folk-lore of every nation would therefore be commensurate with the history of human thought. With literary fairy tales such as those of Hans Andersen, Lord Brabourne, and a host of modern writers, folk-lore has no concern. Doubtless much that is interesting and instructive might be written about these brilliant works, but it would be literary criticism and not scientific investigation.

Perhaps there are some who resent the "teasing-out" of these old and cherished stories—who regard the microscopic method as mere sacrilege. Sentimentalists have talked of rubbing a butterfly's wing in order to improve the exquisite hues of nature, and so forth. Wordsworth has held up to poetic scorn the man of science as

> "One that would peep and botanise
> Upon his mother's grave!"

But he was not just. Nature is none the less, but rather the more, a source of reverence and beauty the deeper we penetrate into the *penetralia* of her secrets. One may still hold the simple faith that every flower enjoys the air it breathes, and at the same time be able to describe it in scientific terms, and assign it to its proper class in the system of Linnæus.

The science of folk-lore may be said to have fairly established this position: "Folk tales are a faithful reflection of the world as it appeared to the primitive mind; and we may be sure that any idea which commonly occurs in them, however absurd it may appear to us, must once have been an ordinary article of belief." We are thus furnished with a thread which leads us back like the clue of Theseus to the labyrinth of the days when the world was young. The warp of these tales is frequently older than the Pyramids, though the woof has been woven and re-woven by generations of conscious story-tellers until the separation of the elements becomes a task of extreme difficulty.

Perhaps we shall best obtain some elementary ideas as to the nature of the old beliefs, fears, griefs, and glories enshrined in these ancient mosaics if we examine one well-known story still cherished in the nursery and the infant school. Every one knows the story of Cinderella, which Professor Sully tells us is best fitted, by its simplicity as well as by its romantic and adventurous character, to please and engross the young imagination. In its English form it came to us from the French of Perrault, who made his collection in the tight-laced, high-heeled, tea-cup days of Louis the Fourteenth. Perrault's stories, we are told, came in their rustic weeds; they wandered out of the cabins of the charcoal-burners and out of the farmers' cottages, and after many adventures reached the enchanted castle of Versailles, where the courtiers welcomed them gladly, recognised the truant boys and girls of the fairy world as princes and princesses, and arrayed them in all the splendour of a splendid and frivolous court.

Every one recalls the story—the pretty stepchild whose beauty and good nature render her odious to her sisters, her hard lot, her mean apparel, her lonely seat by the chimney corner amidst the cinders and ashes; the departure of the gorgeously-arrayed sisters for the ball; the solitary child's grief; the visit of the fairy godmother; the magical appearance of coach, horses, and attendants; the cloth-of-gold dress; the jewels and the glass slippers; the warning about returning at midnight—a most salutary admonition, that might well be laid to heart by modern maidens for the preservation of their complexions and the *husbanding* of their youth—the delight of the ball; the subjugation of the young prince; the flight; the loss of the slipper; the grief of the royal lover; the proclamation, and the triumph of the despised kitchen-girl. All this is too familiar to need more than a momentary recapitulation.

Now, perhaps it may be news to some of my readers that there are more than four hundred versions of this story in existence. By the waters of Father Nile, in Zulu kraals, in Maori huts, in the snow-dwellings of the Eskimo, in the wigwams of the noble Red Man, as well as in all the countries of Europe, Cinderella, in one form or another, has lighted young eyes, ravished young ears, and charmed young hearts. It will be instructive to examine a few variants of this far-travelled tale. The German version, as presented by the brothers Grimm, at once reveals the points of difference between the modern literary version and the ancient folk tale. As the Grimm rendering may not be familiar to all my readers, I briefly recount the story.

A rich man with an only daughter marries again. The new wife brings with her two daughters, fair of face but black of heart. The stepchild is cruelly treated, and banished to the kitchen, where in rags and dejection she spends her miserable days. When the father is about to set off for the fair, he asks the girls what fairing he shall bring them. One asks for beautiful dresses, another for jewels, but Cinderella asks for the first branch which knocks against his hat on his way home. The father brings his daughters what they desire, and Cinderella plants the hazel branch on her mother's grave, which she constantly visits, and waters with her tears. The branch grows into a handsome tree. Thrice a day Cinderella sits beneath it praying and weeping. One day a little white bird appears, and plays the part of the fairy godmother in Perrault's version. The bird throws down to her all that she asks of it. Then follows the king's festival, at which the prince is to choose his bride. The sisters prepare for the ball, and poor Cinderella entreats her stepmother to let her go too. Wearied at her importunity, the stepmother sets her a task. "See," she says, "I have emptied a dish of lentils into the ashes. If thou hast picked them out again in two

hours, thou shalt go with us." Cinderella goes into the garden, and calls on the birds to help her. The birds come at her call, and long before the two hours are up the lentils have been picked out of the ashes. The stepmother, however, will not keep her promise, but sets Cinderella another task. She empties two dishes of lentils amongst the ashes this time, and promises that if they are picked out in one hour the child shall go to the ball. Again the birds come, and the task is quickly performed. The stepmother, however, is ready with another and final excuse—Cinderella has no suitable dress. When the party has set off for the ball, Cinderella goes to her mother's grave beneath the hazel tree, and cries,—

"Shiver and quiver, little tree,
Silver and gold throw down to me."

The bird on the tree at once throws down a dress and shoes of gold and silver, and Cinderella goes gaily to the ball. From this point the tale is somewhat similar to Perrault's. Cinderella's beauty enslaves the young prince, who, after the manner of swains all the world over, desires to see her home. The girl, however, escapes from her persistent admirer, and reaches home in time to receive her returning relatives. The festivities are continued next day, and again, thanks to the little bird on the tree, Cinderella appears even more ravishingly attired than on the first occasion. A third day she appears still more wondrously clad, and in her flight loses a slipper. Then come the proclamation and the trial of the slipper. By cutting her toe off, the elder sister manages to squeeze her mutilated foot into the shoe, and forthwith rides away with the prince's attendants. As they pass the hazel tree, the bird cries,—

"Turn and peep, turn and peep,
There's blood within the shoe;
The shoe it is too small for her,
The true bride waits for you."

The fraud being detected, the other daughter has her chance. She bites off her heel, swallows the pain, and rides away in her turn. Again the bird exposes the fraud, and Cinderella's turn arrives. She slips on the shoe without martyrdom, the bird approves, and the wedding takes place.

In Russian Karelia we find a version which opens in a singularly dramatic and original fashion. A man and his wife had one fair daughter and one sheep. The sheep wandered away, and the wife sought it in the woods, where she met a witch-wife, who turned the woman into a sheep, and herself took the form of the woman. The witch-wife was welcomed by the husband as his wife, and the sheep accompanied her. The strange new stepmother, after a time, begged her husband to kill the sheep, the real mother of the heroine. He concurred, and a feast was prepared. The daughter, warned by the sheep before its slaughter, refused to partake of the meal, and gathering the bones, buried them with pious care. From them grew up a birch tree. The man and his witch-wife then went to court, leaving the disappointed girl to accomplish a number of impossible tasks. The voice of the dead mother from the grave below the birch bade the girl break a twig from the tree. She did so, and easily accomplished the appointed tasks. Then out of the earth came beautiful raiment, in which the girl went to court. The prince fell in love with her, and finally detected his inamorata by means of a ring, which in this version takes the place of the slipper. Then comes the frequent episode of a false bride substituted by the witch-wife, a number of trials, and the final punishment.

In Servia we have a somewhat similar version. Three girls are spinning near a cleft in the ground, and are warned by an old man that if they let their spindles fall into the cleft their mother will be changed into a cow. One of the girls lets her spindle fall, the mother suffers the fate foretold, and the girl lovingly tends the cow. Her father marries again, and the new wife drives the child to the kitchen amongst the cinders. She then persuades her husband to kill the cow, and a feast takes place. The girl refuses to eat the kindred flesh, and buries the bones in the hearth. From these spring two white doves, which supply the Servian Cinderella with splendid raiment, in which she wins the love of the prince, after the usual attempt to substitute a false bride, frustrated by the warning of the birds.

A modern Greek variant is almost identically similar. In the Highlands of Scotland the persecuted stepdaughter is aided by a ram, which is killed, but its bones are buried. Then it comes to life again, but is lame, for all its bones were not collected. The ram then plays the part of the fairy godmother. In the Lowlands a red calf takes the place of the ram, and aids the child. Amongst the Hindus, the Norse, Bretons, Teutons, Spaniards, Finns, and Italians we find variants of this same story wonderfully similar in their main ideas. Individual fancies and local influences have created superficial differences, but of their essential similarity there can be no doubt. It is this essential similarity in tales garnered from the ends of the earth which creates the Sphinx riddle of folk-lore. Before, however, we attempt to solve it, let us note some of the points of difference between the legendary forms of the story and the literary version of Perrault.

In the first place, the fairy godmother is distinctly a modern interpolation, due to the taste and judgment of the French writer. He boggled at the metamorphosis and the other barbarous details of the ancient versions, and substituted an airy spirit of wholly benevolent disposition. In Gaul the woodland deities refused, for centuries, to be annihilated by the powers of Christendom. The high altars of pagan worship fell, but not the rustic faith in the tutelary spirits of wind and stream, cloud and wood. Here was a supernatural element ready at Perrault's hand, and capable of being treated *à la* Watteau. Then, again, Perrault suppressed the false bride, so common as a suspensory incident to lengthen interest and heighten the final triumph. He used the fairy godmother in an eminently artistic way to provide an excellent reason for Cinderella's hurried exit from the ball, and to impress upon all and sundry the duty of faith to promises. Perrault, too, could not suffer the barbaric justice rigorously demanded in the old versions. He makes Cinderella forgive her sisters, and thus casts the mild light of Christianity over all.

Now the legendary versions will have none of this. Justice must be done, though the heavens fall, and done to the music of the marrow bones and cleavers. The traditional versions will have their pound of flesh—an eye for an eye, and a tooth for a tooth. "Begging pardon won't do," says the ruffian in the anecdote; "you must have a smack in the mouth." This is the spirit of the ancient folk tales. In the German version the pigeons peck out the eyes of the wicked sisters. An Italian Cinderella out-Herods Herod. She breaks her stepmother's neck with the lid of a chest!

(To be continued.)

Our Modern Language Section

ON THE STUDY OF GERMAN.

I.

WE propose in a short series of papers to put in a plea for the more extended study of German, to indicate broadly the chief difficulties attending the acquisition of that language, and to sketch out a course of reading for the student.

Amidst great and increasing educational activity there are two features not at all satisfactory. One is the way in which instruction is dominated and determined by the requirements of examinations, and the other arises from the fact that the view taken of education amongst us is far too utilitarian. Each of these considerations tells in its way against the study of German. German is not looked upon as an easy subject to prepare for examinations, and when, in a specific examination, an alternative between French and German is permitted, the language which is reputed to be the easier secures the choice. We advisedly say "reputed to be," for it is our own opinion that it would take an Englishman, at any rate, less time to learn to write and speak passably good German than to write and speak equally good French. The utilitarian view of education also operates against the study of German. What is the use of it to an ordinary man? If he travels on the Continent, his own language and French will carry him almost anywhere, German-speaking countries included. The man of science and the philologist may find German useful, as a knowledge of it will enable them to read works on their favourite studies which have not been translated into English, and help them also to keep up with the latest developments and theories relating to their pursuits. From the utilitarian standpoint, the teacher who wishes to keep himself quite up to date should be able to read and speak German. From Germany have come many discoveries in educational theory and practice which have been of the greatest service to the world at large, and the German holiday courses in the science of pedagogics can only be thoroughly followed by those who are able to understand spoken German fairly well. We are convinced that there is a third reason which operates against German being studied as much as it should be with us. We are not, as a general rule, prepared to take the trouble over the study of foreign languages that we take over other subjects of study. Perhaps it is hardly fair to put it in this way, but there is still with us a great proportion of the time devoted to the study of foreign languages which is practically wasted. The better methods of teaching foreign languages which are coming more into vogue are doing something to lessen this waste of time; but even when these are employed, the pupil in many instances does not read enough. The practice of not prescribing particular text-books for an examination in modern languages is becoming more common; and even where these are set, an option is often allowed between taking the prescribed book and a course of general reading.

The idea of the difficulty of German is to a large extent derived from its involved construction. This has been often caricatured by humorous writers here and in America, and perhaps these burlesques have given English people an exaggerated idea of the difficulty of German construction. It must be remembered, however, that there are many gradations in the degree of complexity which German writers permit to themselves in the construction of their sentences. The man who can read the German of a newspaper, a novel, a poem, or even a scientific work, with little trouble, may feel, when he first tackles a philosophic work, that he knows no German at all. Even then it is largely a question of mastery of style, and when he has carefully read the first thirty or forty pages, the rest is comparatively smooth sailing. The majority of us do not intend to fly so high as Kant, Schopenhauer, Hegel, and company; but should we at any time feel attracted towards a study of the deeper problems of philosophy, a sound knowledge of German will smooth our path immeasurably.

We do our readers the credit of assuming that, at any rate to a large extent, they desire to learn for the sake of the pleasure that learning brings with it, and to acquire those deeper and broader views that accompany real mental culture. From this point of view there is much to be said for the study of German. In poetry, history, philology, criticism, and philosophy Germany has profoundly influenced European thought, and the man or woman who is unable to read German stands to a large extent outside the effect of this influence. For an Englishman, German is a much easier language to study than it would be to a Frenchman. It is a language belonging to the same great division of the Aryan family as his own. In its vocabulary it is closely allied to the native part of our own vocabulary. In this respect it possesses one great advantage over our own. Practically it has no admixture of foreign elements. The greater part of its words are built up from native roots, and when the student has become sufficiently familiar with these roots, he will be to a large extent independent of his dictionary. Many of the peculiarities of inflection in German are common to it with English. The formation of the plurals of nouns by the modification of the vowel sound and by the addition of *-en*, the formation of the preterite tense of the strong verb and the separable verbs, have analogies in English. Many of the prefixes used in derivation are either quite like English prefixes or are closely analogous to them. Even the past participle prefix *ge-* will be readily understood by any one who is familiar with the corresponding *y-* (*yclept*, *yknowen*) in Middle English. In our next paper we shall endeavour to indicate broadly the chief difficulties in German grammar and syntax, and suggest some ways of dealing with them.

HUMORISTISCHES.

ZWEI EUPHEMISTEN.

(*Im Gefängnis.*)

"WARUM bist Du hier?"

"Wegen der Hitze. Ich hab' Einem eine Ohrfeige gegeben.....Und warum bist Du hier?"

"Wegen der Kälte. Ich hab' einen Winterrock gestohlen!"

GRADMESSER.

Freund: "Nun, Fritz, hast Du gute Nachrichten von zu Hause bekommen?"

Fritz: "Nicht sehr gute, nur 20 Mark."

We very much regret that, owing to the pressure on our space last month, we were obliged to hold over the Modern Language Section.

DIFFICULTIES OF FRENCH IDIOMS AND CONSTRUCTIONS.

VIII.

WE now come to the verb. The peculiar difficulties which an English student finds with the French verb are determined by the peculiarities of the verb in his own language. What these difficulties are we shall be able to see for ourselves by noting the points of difference between the verbs in the two languages. Two important differences exist:—

1. The French verb is more highly inflected than the English verb, and consequently there is less need for the use of auxiliaries. Not only are shades of meaning expressed in French by inflection where in English the use of an auxiliary verb is necessary, but there is a separate inflection in the plural for each person.

2. No distinction of conjugation exists in French analogous to that between our verbs of the *strong* and of the *weak* conjugation.

Dealing with the particular parts of the conjugation of the verb, we find important differences between the finite verb in the two languages in respect of *mood* and *tense*. In the verb infinite the usages of the participles in the two languages present some marked differences. Moreover, the limited use of the passive voice in French leads to important differences between French and English modes of expression.

Moods.—Under this head the most important difference between French and English verbs lies in the fact that every French verb has a pretty fully developed subjunctive mood, with special inflections. In our own language we have now only traces of a subjunctive mood left, and the use of this mood is becoming less and less common. In French, however, the proper use of the subjunctive mood serves to distinguish the cultured from the uncultured person. It is possible to learn by rule when to use the subjunctive in French, but the student who adds to this knowledge of rules a clear idea of the purpose which the subjunctive mood fulfils will be in a better position to determine whether the indicative or the subjunctive should be used in cases where the rules afford but little guidance. The important distinction between the idea of the indicative and that of the subjunctive is that the former deals with statements which affirm something presented to us as a *fact*, the latter embraces those statements which affirm something as a *conception of the mind*. Thus in the sentence, "I *fear* he *may be* ill," *fear* expresses a fact, and is rendered by the indicative, whilst *may be* expresses a conception, which may or may not coincide with fact, and is therefore translated by the subjunctive.

But whilst there is this fundamental difference between the ideas expressed by the two moods, the usages of the French language do not in every case conform to these conceptions of the two moods we are contrasting. If we say, "I hope I *shall find* him at home," *shall find* expresses not a fact, but a mental conception. It is nevertheless translated by an indicative. Again, if we say, "Rachel was the most famous actress who ever *appeared* on the French stage," *appeared* is presented to us as a fact, but is nevertheless rendered into French by the subjunctive. It is necessary, therefore, to distinguish between statements which are technically subjunctive, because expressing conceptions, and those which, according to the rules governing French syntax, are translated by the subjunctive mood. Hence arises the necessity for carefully mastering the rules of the subjunctive in French. Two common mistakes with reference to the rendering of the subjunctive are made by beginners in French:—

1. They are apt to make the subjunctive follow *si* in French. This often arises from the fact that they have been taught, by teachers who have not carefully distinguished between subjunctive *expressions* and the subjunctive *mood* (or *form*), to say that the verb following *if* in English is in the subjunctive mood.

2. Compound verbs in English formed with *may* are often unthinkingly translated by the French subjunctive. The student should be careful to see whether the subordinate sentence in which the verb compounded with *may* comes under the rules of the subjunctive or not.

Tenses.—French has a more extended tense system for its verbs than English has. It has two tenses expressing simple past time (the *imperfect* and the *past definite*), where English has only one. Moreover, the *past indefinite* (formed with *have* and the *past participle*) is often used where we should use a simple preterite. There are thus really three preterite tenses in French to one in English, and the student must carefully distinguish between the uses of these forms. French has also a conditional tense, but the possession of this tense does not represent a real advantage over English, as we can express precisely the same shades of meaning by the use of auxiliaries. The remarks we have to make as to the uses of the three preterite tenses must only be taken in a general sense. Nothing but extended and attentive reading can make a student able to handle these tenses with idiomatic correctness. Broadly speaking then—

1. The *past indefinite* tense (*j'ai parlé, écrit*, etc.) is used of a *single* act which happened in a time not long past; as, *J'ai acheté aujourd'hui un cadeau pour ma mère.*

2. The *past definite* is used of a *single* act which happened in a time long past; as, *J'achetai cette maison il y a vingt ans.*

3. The *imperfect* is used of *customary* or *repeated* acts taking place in past time. It does not matter whether the time is long past or only recently past; as, *Il aimait à se faire remarquer.* Another important use of the imperfect tense is to express a state or action which is interrupted by another. In this case the first verb is put in the imperfect tense, and the second in the past definite; as, *J'écrivais une lettre quand il entra.*

Two important remarks must be made about the *present* and the *future* tenses respectively. In the usages we are about to exemplify, French is much more consistent than English. We say, for example, "*I have been waiting* two hours for you," where we mean that we are *still waiting*. In French the present tense would be used—"*Je vous attends depuis deux heures.*" Again we say, "When you *see* him, ask him to call on me." In this case *see* refers to a future time, and in French will be translated by the future tense—"*Quand vous le verrez, priez-le de passer chez moi.*"

(*To be continued.*)

FRENCH EXTRACTS.

LE DRAPEAU PENDANT LA BATAILLE.

De temps en temps, le drapeau qui se dressait au-dessus des têtes, agité au vent de la mitraille, sombrait dans la fumée. Alors une voix s'élevait, grave et fière, dominant la fusillade, les râles, les jurons des blessés: "Au drapeau, mes enfants, au drapeau!" Aussitôt un officier s'élançait, vague comme une ombre dans ce brouillard rouge, et l'héroïque enseigne planait encore au-dessus de la bataille. Vingt-deux fois elle tomba, vingt-deux fois la hampe encore tiède, échappée à une main mourante, fut saisie, redressée, et, lorsqu'au soleil couché, ce qui restait du régiment, une poignée d'hommes, battit lentement en retraite, le drapeau n'était plus qu'une guenille aux mains d'un sergent, le vingt-deuxième porte-drapeau de la journée.

A. Daudet.

LA FENETRE DE LA MAISON PATERNELLE.

Autour du toit qui nous vit naître,
Un pampre étalait ses rameaux;
Ses grains dorés, vers la fenêtre
Attiraient les petits oiseaux.

Ma mère, étendant sa main blanche,
Rapprochait les grappes de miel,
Et ses enfants suçaient la branche
Qu'ils rendaient aux oiseaux du ciel.

L'oiseau n'est plus, la mère est morte,
Le vieux cep languit jaunissant,
L'herbe d'hiver croît sur la porte,
Et moi je pleure en y pensant.

Lamartine.

HOLIDAY COURSES ON THE CONTINENT.

THERE seems to be an increasing demand for these Courses, and our Continental friends and neighbours are doing their best to supply the want. Naturally enough, the Courses in France are the most numerous, but many good Courses are offered elsewhere. The following is a summary of particulars referring to the latter, and next month we shall deal with the Courses in France.

THE PRINCIPAL FOREIGN HOLIDAY COURSES, 1904.—PART I.

Where held.	Organisation responsible for the conduct of the Course.	Date.	Fees.	Return Fares from London, 1st Class Steamer, 2nd Class Railway.	Lowest Cost of "Pension" per Day.	For further information address:	Principal Subjects, etc.	Important Details.
GERMANY:								
Greifswald	A Committee of University Professors.	July 13–Aug. 1.	20 marks.....	*Via Hook of Holland, £5, 19s. 10d. To Berlin— Via Flushing, £4, 10s. 4d. Via Hook of Holland, £4, 12s. 2d.	3 to 4 marks	Ferienkurse, Greifswald (Prof. Dr. Bernheim).	German, Latin, French, and English Languages, Literature. Methods of modern language teaching. Phonetics, Pedagogy, Hygiene, Natural Science, History, Arts, Geography.	For teachers of both sexes. Special conversation classes for foreigners, conducted on most modern methods. All lectures given by University teachers.
Jena.....	An International Committee of University Professors and others.	August 4–17 (conversation classes continue until August 24).	Entrance, 5 marks. Each course of 12 lectures, 10 marks. Conversation classes (18 lessons and six excursions) 30 marks.	*Via Hook of Holland, £5, 7s. 3d. To Weimar— Via Flushing, £4, 16s. 5d. Via Hook of Holland, £4, 11s. 2d.	3 to 4 marks	Frau Dr. Schnetger, Gartenstr. 2.	Pedagogy, Natural Science, History of Art, Mental and Moral Science, Religion, German Language, and Literature. French and English Education of defective children.	For teachers of both sexes. Renowned for its course of Pedagogy. Conversation classes (elementary and advanced) for foreigners.
Königsberg	A Committee of University Professors and others.	(Date not yet fixed.)	15 marks.....	To Berlin, as above	3 to 4 marks	Ferienkurse, Königsberg.	History and Philosophy of Religion, German Literature and Art, French and English Language, Literature, Phonetics.	Special Language courses for foreigners.
Marburg..	A Committee of University Professors and others.	1st Course, July 11–30; 2nd Course, Aug. 4–24.	40 marks for each course, or for both, 60 marks.	*Via Hook of Holland, £4, 3s. 8d. To Coblence— Via Flushing, £3, 8s. 5d. Via Hook of Holland, £3, 3s. 11d.	2 marks 50 pfennigs to 4 marks 50 pfennigs.	Herr A. C. Cocker, Villa Cranston; or W. G. Lipscomb, Esq., Grammar School, Bolton, Lancs.	Pedagogy; History of German Language, German Literature, Modern History, History of Art; Phonetics, German, English, French; English and French Literature; Modern Language Teaching according to the New Method.	For teachers of both sexes. Conversation classes (elementary and advanced) for foreigners; Special German courses for beginners. Preparatory Courses.
Neuwied..	The Teachers' Guild of Great Britain and Ireland.	August 5–26....	42 marks.....	Via Hook of Holland, £2, 11s. 6d.	4 to 5 marks	General Secretary, Teachers' Guild, 74 Gower Street, London, W.C.	German Language and Literature, Political, Social, and Economic aspects of Germany.	For British and Irish Teachers and others. Both sexes. To promote a knowledge of the language, customs, etc., among the students.
SWITZERLAND:								
Geneva...	Université de Genève.	July 15–Aug. 28.	40 francs, and 6 francs for special conversation classes and correction of written work.	Via Calais, £6, 13s. 8d. Via Antwerp, £6, 17s. 11d. Via Dieppe, £5, 12s. 1d.	4 francs....	M. Bernard Bouvier, Administrateur du Séminaire et des cours de vacances de français moderne à l'Université.	Classical and modern French Literature, French institutions, special classes for study of spoken language, rhetoric, style, syntax, and methods of teaching.	Specially intended for teachers and advanced foreign students of both sexes. [For information regarding boarding houses, address: Comité de patronage des étudiants étrangers, à l'Université.]
Lausanne.	The Faculty of Letters at the University Lausanne.	July 19–Aug. 27.	40 francs.....	Via Calais, £6, 5s. *Via Hook of Holland, £6, 12s. 10d. Via Dieppe, £5, 2s. 4d.	4 francs (possibly 3 francs 50 cents)	M. J. Bonnard. Avenue Davel 17, Lausanne.	Literature, Philology, Phonetics, special study of spoken language. Methods of teaching. History.	For foreigners of both sexes.
Neuchâtel	Séminaire de Français moderne pour étrangers. Académie de Neuchâtel. Faculté des Lettres.	1st Course, July 18–August 13; 2nd Course, Aug. 15–September 10.	30 francs for each course, or for both, 50 francs.	Via Calais, £6, 3s. *Via Hook of Holland, £6, 4s. 10d. Via Dieppe, £5, 0s. 6d.	4 francs....	M. P. Dessoulavy. Académie de Neuchâtel.	General study of French Language and Literature.	For foreigners of both sexes. Elementary and advanced courses.
SPAIN:								
Santander	The Teachers' Guild of Great Britain and Ireland.	August 5–26...	£2, 2s. if name is entered before July 1; otherwise £2, 5s.	London, Paris, Bordeaux, and Irun, £8.	4½ to 5 pesetas if engaged before end of May.	General Secretary, Teachers' Guild, 74 Gower Street, London, W.C.	Spanish Language and Literature. Political, social, and economic aspects of Spain.	For British and Irish Teachers and others. Both sexes. To promote a knowledge of the language, customs, etc., among the students.

Note.—Programmes of most of these Courses may be seen at the Board of Education Library, St. Stephen's House, Cannon Row, Whitehall, London, S.W.

* Special Tourist Tickets, three days' notice required, no luggage registration.

FRENCH PRIZE COMPETITION.

RULES.

1. All translations should be **posted not later than June 8**, and addressed:—PRIZE EDITOR, Office of the *Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.

ALTERATION IN RULE 3.

3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—

Ah! ne lisez pas Rousseau puisqu'il n'est plus à la mode; mais venez prendre hors des villes des leçons de patience, de méditation, de quiétude. Là seulement vous reposséderez ce que la vie citadine supprime: le temps! N'être plus en retard de huit jours ou d'un mois sur sa propre vie, comme on l'est toujours à Paris; s'affranchir de la tyrannie d'une énorme activité artificielle; pouvoir compter les heures et se dire: "Aujourd'hui, il m'en reste une pour réfléchir." Cette heure unique, où vous ne ferez pas de courses, où vous n'écrirez pas de petit bleu, où vous ne verrez pas à la hâte une pièce de théâtre ou une exposition de peinture, pour le vain avantage d'en pouvoir parler—cette heure vide est précieuse entre toutes: elle est celle de votre vie intérieure—et nous ne valons que par là. Or, l'heure quiète, propre à la vie intérieure—retenez ceci qui n'est point banal malgré les apparences—ni Paris, ni les bains de mer, ni les eaux, ni les voyages ne la donnent. On n'en jouit que face à face avec la terre. La vie rurale vous la donne, dans l'extraordinaire silence qui succède aux travaux du jour. Là, vous aurez enfin des minutes pour vous demander: "Où en suis-je avec moi-même? Quels sont mes projets? Où vais-je, et en quel point suis-je parvenue?" N'est-il pas douloureux de penser que des jeunesses entières d'hommes et de femmes s'écoulent sans qu'ils aient, sans qu'elles aient une seule fois réservé cette heure de loisir, cette heure de vie intérieure, pour s'examiner et se reconnaître? MARCEL PRÉVOST.

RESULT OF THE APRIL COMPETITION.

The prize is awarded to "Vidite." Will "Vidite" kindly send name and address for publication?

First Class.—Fittick, Josiah, Arethusa, Arsanca, Adlitam, Traduzco, Racine, Mogadore, Beth May, La Printanière, Redivivus, Ceylon, Oxford, Kettering, C.E.M., Rus, D'Arcy, Quædam, Encore une autre, Agaznog, Jet, Amry, Pamphilon, Myosotis, Ende gut, Alles gut, Harold, Caper, Miladi, Deploy, Holiday, Tyro, Blinsee, Nemo, Minnehaha, Essex, Lucien, Albano, F.S.Q., L'hommeau, Colet, Edelweiss, Day Dawn, R.J.C., Isis, Bluebell, Doe, Kelso, Perseverance, Welburn, Pathos, Nythsdale, Bracebridge, Daddy, Sir Billy, Gawayn, Cœlia, Helen, M.D.C.M., Emdy Elem, Samoht, Tavistock, Wilcove, Home, Shakspere, Bea, Mathilde, Lissa, Corona, Jabberwock, Saphax, Speranza mia, Misunderstood, Chesterfield, Canton, Mo, Dolores, Claren, Uncle Ned, Schwarz, Menzies.

Second Class.—Cœur-de-Lion, A.C.B., Belinda, Bam, Robbie, H.R.N., Vergilius, Ephèbe, Olicana, X.Y.Z., Elise, Marie, Une Anglaise, Greville, Frau Sorge, Hoffnung, E.R., Meriden, Mountaineer, Noynek, Sans souci, B.G., Theodora, Lady of the Lake, Thule, Sore, Elm, F.M.W., Aleyn, R.N., Rusticus, Janet, Omar Khayyam, Croissant, Celestine, Quithel, Weel Brewer.

Sent together, with one coupon between them—Cleopatra, Phœbus, Desdemona, Scotia.

Report.

A somewhat large number of very good translations was sent in this month. The central idea of the piece was well grasped by most of the competitors, and the chief mistakes arose in the translation of detached phrases. Thus *spécialement savant en quoi que ce soit* was translated "specially knowing what's what." This reminds us of the hero of *Hudibras*:—

> "He knew what's what; and that's as high
> As metaphysic wit can fly."

Many translated *numismate* by the awe-inspiring word "numismatologist." This word has, we regret to say, the authority of some dictionaries. The reference to the *Collège de France* was badly translated by some who did not realise that its foundation dates several hundred years back, and that the contrast drawn is between the character of the instruction given in it now and that which was given there in the years immediately following its foundation.

Four candidates sent up papers in one envelope which contained only a single coupon. We have merely acknowledged the receipt of these papers, which have not been examined. It is expected that every candidate shall be individually a subscriber to the paper.

"LA PRINTANIÈRE'S" letter has been forwarded to the proprietors of the *Practical Teacher*.

The Prize Editor begs to thank several subscribers for their kind expressions as to his efforts to provide good specimens of French literature for translation into English.

Prize Translation.

To be a cultured man does not mean being very learned in any one particular subject. A numismatist, deeply versed in his subject, may be a man without culture if he does not possess that general grasp of ideas thanks to which, according to the saying of Terence, nothing of human interest is foreign to one. True culture is general; it is the opposite of specialisation. You will be told that specialisation alone is to be desired at the present time, because society needs members who excel in their own branch of study. You will even be told that it alone is possible, because the storehouse of knowledge has increased enormously, and because the human mind, if it wishes to obtain this knowledge, is foredoomed to failure. You will boldly reply to these enemies of general culture that their reasons are of no value. It is not true that before it can be called cultivated there is more for the mind to understand and retain than there was, for instance, in the sixteenth century. Then, as at the present day, there were theories about physics and chemistry, a science concerning the earth and the elements: if the idea occurs to you to open one of the books of that time, you will see that though these theories were less founded upon observation, they were not, on that account, simpler. In addition, general culture at that time was burdened with a confusing mass of sophistry, which in our time has vanished. Believe me, an idler in his own interest would do better in following the studies of the Collège de Paris under M. Gaston Paris, than he would have done soon after the foundation of the college. Besides, to-day as then, a specialist without general culture was an incomplete organism, and was valued as such. And doubtless this desire of the artists of the Renaissance to know something of everything was the cause of their being the greatest artists the world has seen. VIDITE.

L'INDUSTRIE ET LES SCIENCES.

LA force et la puissance des nations ne résultent pas seulement de la fertilité de leur sol, de son étendue, de sa population, de la richesse et de la liberté des individus. La puissance des nations se compose sans doute de tous ces éléments, mais c'est à l'industrie qu'il appartient de les mettre en œuvre et d'en faire un tout organisé.

L'industrie est la vie d'un état civilisé; sans elle, les terres demeureraient sans culture, les pâturages sans bestiaux; sans elle, la laine de nos troupeaux ne se transformerait pas en étoffes précieuses; en un mot, il n'existerait de fabriques d'aucune espèce. Mais cette industrie qui donne le mouvement à tout, qui vivifie tout, emprunte elle-même sa force d'une impulsion première, et ce sont les sciences qui la lui donnent. LAVOISIER.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teachers' Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SCHOLARSHIP COURSE FOR DECEMBER 1904.
Sixth Month—June.

Work to be Prepared.

1. *Reading and Repetition.*—Regular weekly practice, orally and before a competent critic.

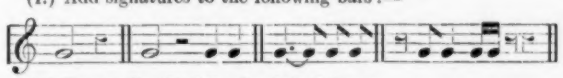
2. *Teaching.*—The teaching of writing—Chap. vi., *Scholarship School Management.* Good handwriting is a most important qualification for every one. It is an easy subject to teach, one of great interest to the pupil, which does not call for any very great mental exertion, and yet in many cases the results are very inferior. The cause of this indifferent writing, which has more than once drawn a special circular from the powers that be, is not far to seek. Like many other simple subjects, the results are not commensurate with the time expended upon it, because the teacher fails to understand the simple principles which underlie the subject, and sets himself to do something in sheer defiance of the laws of nature. What constitutes *good* writing? It must be legible, which depends upon uniformity of size, slope, and distance; it must be produced easily and rapidly; and it should be characterised by beauty of form. The first point is secured by strict adherence to definite rules and plenty of practice, the second and third by a proper method of sitting and of holding the pen. Bad habits are frequently contracted in the infant school. There the child works with a pointed pencil which will make a uniform stroke held in any position. If the wrong one is adopted and the habit acquired, it is most difficult to eradicate when the child comes to write with a pen, which must be held squarely on the two points. Strict attention to detail is necessary, but as early as possible a continuous style should be adopted—that is, the child must not remove the pen or pencil from the writing surface more frequently than is absolutely necessary. Freedom produces beauty of form. If the letters are built up laboriously from small fragments, it is absolutely impossible to produce beautiful writing. Full explanation is given in the text-book as to the proper method of holding the pen.

3. *Drawing.*—One or two copies each week from photos of casts, and practice from natural objects. I am still dissatisfied with the specimens sent up for correction. Students seem to fail entirely in recognising the main lines on which a copy is built up. The spiral is by far the commonest, and this should be practised assiduously. Smooth, flowing lines must be the aim of every one.

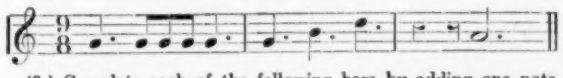
4. *Music.*—Time (staff notation) and time signatures. Distinguish between duple and triple, simple and compound. Note that $\frac{6}{4}$ time is duple, not triple.

The following are typical government questions:—

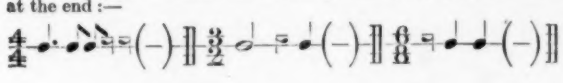
(1.) Add signatures to the following bars:—



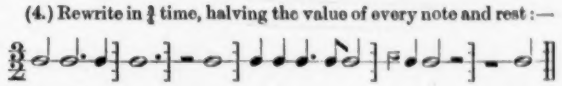
(2.) Transcribe the following into $\frac{9}{8}$ time:—



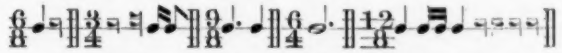
(3.) Complete each of the following bars by adding one note at the end:—



(4.) Rewrite in $\frac{3}{4}$ time, halving the value of every note and rest:—



(5.) Complete each of the following bars, in accordance with the time signature, by adding two notes at the end.



5. *Penmanship.*—Ten minutes' daily practice, and care at all times. The practice should be taken from a good copy-book—for example, *Practical Teacher's Copy-Book*, specially compiled for pupil teachers.

6. *Composition.*—Write one or two essays each week on such subjects as:—

(1.) Technical education.
(2.) "Sweet are the uses of adversity."
(3.) Why is London the greatest city on earth?
(4.) The National Debt.
(5.) "All is not gold that glitters."
(6.) Forest trees.
(7.) Is war justifiable?
(8.) The Revival of Learning.

Read up the subject if necessary. Make out a definite plan. Mark the commencement of a new section by beginning a new paragraph. Spare yourself no pains in correcting and polishing sentences and expression.

The following notes will suggest the lines to take:—

(1.) (*a*) Distinguish between general education and technical education, the latter being a special training for some particular art, either by teaching the art direct or by teaching the scientific principles which underlie it. You will find plenty of material in the report of the Mosely Commission.

(*b*) The value of it (*a*) to the workman, by increasing his intelligence, etc.; (*β*) to the nation. As a manufacturing nation we are bound to give more attention to it than a country like Spain or Turkey.

(*c*) Explain if you can what is being done in your own locality.

(2.) All philosophers are agreed that it is only in adversity that the *real* character of the individual appears. When everything goes well and a man has all that he needs, there is a tendency to relax effort, to lose character, to develop the inferior qualities. The mental and moral training produced by facing and overcoming difficulties, on the other hand, develops the best side of a man; he puts forth all his energy, concentrates his mind, uses all his resources, etc. Examples can always be found. It was in the direst necessity and adversity that many of our finest poems were produced, pictures painted, and books written. Milton, blind and poor, wrote *Paradise Lost;* Bunyan, in the greatest need, wrote the *Pilgrim's Progress.*

(3.) (*a*) Its situation on the centre of the land hemisphere.

(*b*) Its situation on a tidal river.

(*c*) Its situation on the crossing of the great roads of bygone times.

(*d*) Its situation with regard to the rest of Europe and to America.

(*e*) The character of the nation of which it is the metropolis.

(4.) The facts will be found in Whitaker or any good history. The question is sometimes asked, "How can a country be prosperous which is over £700,000,000 in debt?" At first sight it seems impossible; but it must be remembered that it is mainly a debt to *itself*—that is, the interest paid is not paid to another country; and secondly, the amount paid as interest annually can be easily afforded by a rich nation. Take a simple example. A shopkeeper, to develop his business, borrows £1,000 at 5%. This entails a yearly payment of £50. But if by means of the £1,000 he can earn £100 a year, he can pay his interest and still be £50 to the good.

(5.) This may be treated as other proverbs.

(6.) To a dweller in towns this subject may need some preparation. The various kinds of trees, their characteristics, their uses, etc., may be taken.

Spenser in the *Faery Queen* beautifully sums up the subject:—

"Much can they praise the trees so straight and high—
The sailing-*pine*, the *cedar* proud and tall,
The vine-prop *elm*, the *poplar* never dry,
The builder *oak*, sole king of forests all,
The *aspen*, good for staves, the *cypress* funeral,
The *laurel*, meed of mighty conquerors
And poets sage, the *fir* that weepeth still,
The *willow*, worn of forlorn paramours,
The *yew*, obedient to the bender's will,
The *birch* for shafts, the *sallow* for the mill,
The *myrrh* sweet-bleeding in the bitter wound,
The warlike *beech*, the *ash* for nothing ill,
The fruitful *olive*, and the *plantain* round,
The carver *holme*, the *maple* seldom inward sound."

(7.) War is sometimes a necessity. When a nation rises in arms to uphold its liberty, to repel invaders, to secure some civil right, etc., it is justifiable.

(8.) This was dealt with in a note last month.

7. *English.*—(*a*) Twenty-five roots and meanings each week.

(*b*) *Much Ado about Nothing*, Act III., Scenes iii. and iv.

(*c*) The essay on "Innovations."

(*d*) The Elizabethan writers.

(*e*) The grammar and syntax of the verb.

Notes.—(1.) Scene iii. of the play is one of the finest pieces of comedy in the whole of Shakespeare's writing. The ignorance and pomposity of Dogberry, his nice "derangement of epitaphs," the sarcasm on the useless watchmen of the period, the novel versions of the laws, make up a most delicious scene. Shakespeare was depicting something of what took place every night in London. The old watchmen, who were supposed to guard the citizens while they slept, were utterly useless. "We will rather sleep than talk; we know what belongs to a watch," says one; to which Dogberry replies, "Why, you speak like an ancient and most quiet watchman; for I cannot see how sleeping should offend!"

(2.) Elizabethan literature is a subject which can hardly be mastered by a lifelong study; there is such a wealth of material, such a variety of expression and thought, that it is well-nigh impossible to fathom the minds of the writers of the age. Of the causes which produced this outburst something was said last month. During Elizabeth's reign England shook herself free from the incubus of the fear of foreign invasion, and the national feeling of exuberance and newly-found strength is reflected in the writers of the time. The literature is characterised by a nervous strength and determination, a wide breadth of view, an energetic force of expression, which were before entirely lacking. It possesses a strong individuality of its own, caused by the historical setting of the time. Men felt strongly and wrote strongly, and what is sometimes condemned by the present age as coarseness is merely rugged strength divested of the superficial polish of later times. Expressions were used in the presence of, and also by, ladies which would hardly be tolerated now in any society; but this can hardly be blamed any more than a child can who, released from the tedium of school, shouts and runs, without the decorum of a grown-up person.

One very remarkable feature of the age is the rapid rise of the drama. The representation of historical scenes on the stage, or the acting of a play to teach the audience some particular lesson, is of great antiquity. The pleasure felt from watching mimic representations is universal amongst civilised nations, and appeals not only to adults, but also to children, whose games are very largely made up of "acting" some character. With the ancient Greeks theatre-going was a very favourite form of amusement, although in some cases the plays were of a semi-religious character.

But the English drama is not derived from the Latin and Greek writers; it has an origin of its own. Early in the twelfth century the clergy conceived the idea of teaching the ignorant populace some of the lessons and truths to be derived from passages of Holy Writ by acting the most striking scenes in the Old or New Testament. These Miracle Plays, as they were called, became very popular. They were acted at first in churches and cathedrals, but as the audiences increased, it was found necessary to erect a platform in some public place. At the appointed time visitors flocked into the town from all the adjacent country, and followed with keen interest the story of the Creation, or Cain and Abel, or the life of Abraham, or the life and passion of Christ. To the present day the little village of Ober-Ammergau, in Bavaria, once in every ten years performs a Passion play, in which nearly all of the inhabitants are actors. The chief incidents in the life of Christ are presented with the greatest solemnity and reverence.

At first the biblical story was strictly adhered to, but later on characters representing such abstract qualities as vice, death, knowledge, beauty were introduced, and the term Morality was given to the play, and frequently the religious aspect was lost in buffoonery and vulgarity.

Another class of plays was known as Interludes, which were generally shorter than the Moralities, and introduced real or historical personages. The scenery employed was usually of the roughest character, though where performances were regularly given, as at Chester, Wakefield, and Coventry, there was an attempt to reproduce scenes with greater fidelity.

While the monasteries were the sole repositories of learning and education, the Miracle Plays, Mysteries, Moralities, and Interludes were comparatively frequent; but with the revival of learning and the improved taste acquired by the study of Greek and Roman masterpieces, and more especially after the dissolution of the monasteries, they practically ceased in England.

Public interest in spectacular representations, however, did not decay, but with greater knowledge rather increased. To supply this want the Elizabethan drama sprang up with remarkable vigour and diversity. The first comedy, *Ralph Roister Doister*, was written by Nicholas Udall in 1540, and the earliest tragedy was *Gorboduc*, or *Ferrex and Porrex*, by Thomas Sackville. The latter was acted before Queen Elizabeth by the gentlemen of the Inner Temple in 1562.

Although the profession of "play-actor" was far from being an honourable one—for they were classed in an old law with "rogues and vagabonds"—the public demand for drama led to a great increase in production, and such dramatists as Greene, Ford, Massinger, Marlowe, Peele, Kyd, Dekker, and, prince of them all, Shakespeare, wrote comedies, tragedies, and historical plays which in many cases still remain as English classics.

The characteristics of these plays are high and fertile imagination and richness of vocabulary. The stirring events of the age influenced the writers enormously, and the "Elizabethan choir of song, sweet and strong," has never been surpassed.

(3.) The grammar of the verb is of great importance. Exact definitions must be carefully committed to memory. The points which require more particular attention are—(*a*) classification, (*b*) voice, (*c*) the subjunctive mood, (*d*) the gerund, (*e*) the auxiliaries, and (*f*) the defective verbs.

8. *Geography.*—(*a*) Finish the revision of Asia.

(*b*) Provinces, towns, and government of British North America.

The following government questions may assist in revision of Asia:—

(1.) Give some account of the rivers Indus and Euphrates.

(2.) What do you know of the government, trade, and political importance of Afghanistan?

(3.) Where and what are Chitral, Formosa, Fujisan, Armenia, Terai, Amu, Hoangho, Vladivostock, Kashmir, Nepal, Mecca, Red Sea, Borneo, Amoy, Korea, Samarcand, Persepolis, Doab, Tomsk, Damascus, Jaffa, Tonkin, Teheran, Kandahar, Tundras, Goa, Aleppo, Yemen, Khelat, Rangoon?

(4.) What do you know of the Caspian Sea and its shores?

(5.) Write an account of the Trans-Siberian Railway.

(6.) Say what you can about Persia.

(7.) Name two important groups of islands lying off the coast of Asia, and write a full account of one of them.

(8.) The mountain chains which enclose the Chinese Empire form the great watershed of Asia. Name the mountain chains, and show the truth of the statement.

(9.) Say what you know about China as regards its people, productions, industries, and chief places of interest.

(10.) Describe a coasting voyage from Rangoon to Pekin.

(11.) Explain, in words or by a sketch-map, the position and importance of Korea in relation to China, Japan, and the Russian Empire.

(12.) Say what you can of Ceylon, and illustrate your answer by a sketch-map.

British North America. Note the difference between provinces and territories. The former possess a legislature of their own; the latter are governed by the Dominion Government. The term Dominion of Canada does not mean British North America. In the middle of last century there were the *separate* colonies of Newfoundland, Nova Scotia, New Brunswick, Prince Edward Island, Upper and Lower Canada (now Ontario and Quebec), and British Columbia. In 1867 the British North America Act was passed, which united Ontario, Quebec, Nova Scotia, and New Brunswick, under the title of the Dominion of Canada, and provided for the admission at any subsequent period of other provinces and territories. In 1870 the province of Manitoba was formed, and together with the North-West Territory admitted. British Columbia joined in 1871, Prince Edward Island in 1873. Newfoundland has not joined, and is not part of the Dominion.

In 1882 the Dominion Government formed four provisional districts—Assiniboia, Saskatchewan, Alberta, Athabasca; and in 1895 the rest of the territory to the north was divided into four districts—Ungava, Franklin, Yukon, Mackenzie.

The Dominion Government, which meets at Ottawa, consists of:

(1.) The governor-general—the Earl of Minto.

(2.) The Senate, appointed for life by the Crown. Eighty-one members.

(3.) The House of Commons, elected for five years, of 213 members from the various provinces, in proportion to the population.

Each province has its own legislative assembly, to deal with and legislate for local affairs. Every student should write for some of the excellent handbooks and pamphlets issued by the Dominion or provincial governments.

The following questions have been asked:—

(1.) Describe a journey across America by the Canadian Pacific Railway.

(2.) Name the provinces which form the Dominion of Canada, and give the principal towns and industries of each.

(3.) Say what you can of the following:—Anticosti, Halifax, Hudson Bay, Mackenzie, Ottawa (city), Vancouver City.

(4.) Give a short description of British Columbia, and account for the difference between its climate and that of Labrador.

(5.) Name four ports in British North America, giving a short account of each.

(6.) Describe as accurately as you can the situation and natural surroundings of Calgary, Regina, Winnipeg, Quebec, and St. John's (Newfoundland).

(7.) Give some account of the growth of the Dominion of Canada.

(8.) What provinces are included in the Dominion of Canada? Who determines whether a province shall or shall not be admitted into the Dominion? Give brief notes of a journey from Halifax to Niagara.

(9.) What is the most thickly populated part of British North America? Describe the position and explain the importance of Halifax, Quebec, Montreal, Vancouver, and New Westminster.

9. *History.*—The Tudors.

Notes.—(1.) Causes of great personal power exercised by the Tudors:—

(*a*) The old nobility had exterminated one another by the Wars of the Roses, and the new nobility was subservient to the kings.

(*b*) The Church was dissolute and lazy. The Reformation took away all power.

(*c*) The House of Lords naturally fell with the nobility.

(*d*) The House of Commons, owing to the Disfranchising Act of 1430, was dependent on the king and the nobility.

(*e*) The people were tired of civil war and misrule.

(*f*) The kings possessed the only artillery in the kingdom.

(*g*) Personal character of the Tudors.

In connection with (*a*) note the Statute of Livery and Maintenance.

(2.) Henry the Seventh's ways of obtaining money:—

(*a*) Yorkist estates confiscated.

(*b*) Forced loans and benevolences (Morton's Fork).

(*c*) Fines by the Star Chamber for breaking obsolete laws (Empson and Dudley).

(*d*) Subsidies from Parliament for war, and grants from the French to refrain from so doing.

(*e*) The dowry of Catherine of Aragon.

(3.) The Star Chamber, instituted in 1486—a committee of the Privy Council. Tried without a jury, therefore illegal. Attacked men whom the ordinary laws could not touch, its aims being to crush the nobility, punish rebels and offenders, fill the treasury. It inflicted torture, fines, imprisonment—anything short of capital punishment. Though useful at first in obtaining and keeping order, it became, under the Stuarts, a private means of tyranny.

(4.) The Reformation:—

Causes—The wealth and corruption of the Church; the Papal schism and the vices of the Roman court; the sale of indulgences; in England, the desire of Henry the Eighth to divorce his wife, which led to separation from Rome.

Points on which the Protestants differed from the Church, which they opposed—Transubstantiation, the belief that the substance of the elements was changed in communion; communion in one kind; the doctrine of purgatory; celibacy of the clergy; auricular confession; masses for the dead; the worship of the saints, etc.; the use of the Latin instead of the vulgar tongue.

(5.) The dissolution of the monasteries, an act of spiteful plunder on the part of the king, produced serious effects in England. With all their faults, the monks were easy landlords and friends to the poor, who could always rely on charitable assistance. The monks cultivated the ground and employed large numbers of workers; the new owners enclosed common lands, turned the fields into sheep runs, and threw thousands out of work. Hence great discontent and distress, as indicated by (*a*) the Pilgrimage of Grace, (*b*) Ket's Rebellion. The question "what to do with the poor" became an important one. In 1547 a severe Act was passed against vagrancy, but with little effect. Stringent legislation will not at any time stop hunger. In 1562 another Act was passed calling upon overseers to collect alms for, and provide work for, the needy. But it was not till the great Poor Law of 1601, which established workhouses and made each parish maintain its own poor, that anything like a solution of the difficulty was arrived at.

(6.) Elizabeth's foreign policy must be carefully noted.

(*a*) A pretence at marrying—for example, Philip of Spain, 1558; Earl of Arran, 1560; Henry of Anjou, 1571; Francis of Anjou, 1579.

(*b*) Keeping Spain occupied in the Netherlands by helping the insurgents there.

(*c*) Keeping Spain occupied by assisting the Huguenots.

(*d*) By countenancing the piratical raids of Drake, Hawkins, Grenville, etc.

(7.) Commercial development under the Tudors is important.

Lives of all important men must be learned. Note the difficulties which confronted Elizabeth, and how they were overcome.

10. *Arithmetic.*—Work 501–600 General Examples, Christian and Collar. Revise profit and loss and interest. Work those sums only which present difficulty. Take particular care in setting down the solutions; use sufficient words to make the method quite clear. Work all interest by method of unity and not by formula.

Solutions asked for:—

(1.) *Find a fraction whose denominator exceeds its numerator by 7, and if 5 be added to each term the fraction is equal to* $\frac{3}{4}$.

Let N = the numerator, then N + 7 = the denominator, and the fraction is $\frac{N}{N+7}$.

Add 5 to each term, then $\frac{N+5}{N+12} = \frac{3}{4}$,

or $4N + 20 = 3N + 36$.

$N = 16$. Ans. $\frac{16}{23}$.

(2.) *A rower finds he can row up a stream 6 miles and back again in 2 hours 6 minutes, when the stream is running 3 miles an hour. Find his rate in still water.*

Let R be his rate.

Then up-stream he goes R − 3 miles per hour.

Down-stream he goes R + 3 miles per hour.

$$\text{Time taken} = \frac{6}{R-3} + \frac{6}{R+3} = \frac{12R}{R^2-9} = \frac{21}{10}.$$

Whence $21R^2 + 140R - 189 = 0$.

$7R^2 + 40R - 63 = 0$.

$(R - 7)(7R + 9) = 0$. $\therefore R = 7$.

(3.) *A person invests part of* £1000 *in* $3\frac{1}{2}$ *per cent. stock at* 80, *and the remainder in* 5 *per cent. stock at* 112, *and his joint income from both was* £44, 1*s.* 3*d. Find the amount of each investment.*

Investing it all in the $3\frac{1}{2}$ %, the interest is $\frac{1000}{80} \times 3\frac{1}{2} = 43\frac{3}{4}$.

Investing it all in the 5%, the interest is $\frac{1000}{112} \times 5 = 44\frac{8}{14}$.

The first is $\frac{5}{16}$ less than the required amount, the second $\frac{6}{112}$ more. Therefore the money must be divided in the ratio $\frac{6}{112} : \frac{5}{16}$, or 13 : 7. Ans. £650; £350.

11. *Algebra.*—Chapter xxix., Hall and Knight. Miscellaneous theorems and examples.

12. *Euclid.*—Props. 1–4, Book II., with six deductions per week.

13. *Elementary Science.*—Elementary properties of water, carbon dioxide, lime, and silica.

14. *General Information.*—Read up answers to two or three of the papers in the book of questions used.

Test Paper in General Information.

☞ Answers will be marked gratis if sent direct to Mr. A. T. Flux, Oakleigh, Belvedere, Kent, with stamped addressed envelope for their return.

1. Explain the conditions under which a delta is produced.

2. What is meant by stratified and unstratified rocks? To which class do sandstone, granite, basalt, clay, limestone, chalk, gneiss, and dolomite belong?

3. Explain carefully the process of fertilisation in a flower.

4. Where do the following articles come from, and for what are they used:—pimento, sassafras, assafœtida, indigo, opium, cochineal, cinnamon?

5. Draw a genealogical table showing the descent of Edward the Seventh from Henry the Seventh.

6. What is the difference between a solicitor and a barrister, a magistrate and a judge, a tax and a rate, a hill and a mountain?
7. Mention half a dozen of the chief English living authors, and give as many of their works as you can.
8. To what events do the following refer?—

(*a*) "He nothing common did or mean
Upon that memorable scene."

(*b*) "There was a sound of revelry by night."

(*c*) "News of battle! news of battle!
Hark, 'tis ringing down the street."

(*d*) "A band of exiles moored their bark
On the wild New England shore."

(*e*) "Her crew had seen Castile's black fleet."

(*f*) "'Now that I cannot tell,' said he,
'But 'twas a famous victory.'"

Test Questions on the Month's Work.

1. Write as specimens of copy-setting:—
Large hand.—*Alfred Tennyson.*
Small hand.—*And the red glare on Skiddaw roused the burghers of Carlisle.*
2. What are some of the common mistakes made in the teaching of spelling? Give a sketch of a good lesson in spelling to Standard VI.
3. Explain the causes of the present war between Russia and Japan.
4. What are the chief industries and productions of Siberia? What steps have been taken to develop them?
5. Write a short essay on the waterways of British North America.
6. Explain clearly why we lost the French provinces in the reign of Henry the Sixth.
7. What were the chief effects of the Wars of the Roses?
8. Work the following sums:—
(*a*) A railway incline rises 1 foot in 80 in the first $\frac{1}{4}$ mile, then 1 in 120 in the next 1500 yds., and 1 in 110 in the next $\frac{1}{4}$ mile. Find the average rises. Ans. 1 in $108\frac{6}{13}$.
(*b*) How much per cent. will be added to a person's income by a reduction in the income tax from 10d. to 6d. in the £, if his income in the first instance was £350, 13s. 4½d.? Ans. $1\frac{17}{23}$.
(*c*) A ship depreciates in value each year at the rate of 10% of its value, and its value at the end of 3 years is £14,580. What was its original value? Ans. £20,000.
(*d*) If $\frac{7}{12}$ of an estate be worth 200 guineas, and the value of the estate be increased ·075 per cent. by improvements, find the value of $\frac{3}{5}$ of the improved estate. Ans. £280, 4s. $2\frac{2}{5}$d.
9. Describe the experiments you would work with a class to show the properties of mercury.
10. Find a square equal in area to the sum of squares on lines 1 in., $1\frac{1}{2}$ in., 2 in., and 3 in. long.

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1904.

1. *Reading and Repetition.*—Take regular practice in these subjects, orally.
2. *Penmanship.*—Write a page in the *Practical Teacher's Copy-Book* each day, and take great care at all times.
3. *English.*—(*a*) *Lay of the Last Minstrel.* Prepare the first twenty stanzas of the *Lay.* Learn the meanings of all allusions, and be prepared to parse and analyse any word.
(*b*) Ten roots each week.
(*c*) The Anglo-Saxon suffixes.
(*d*) The grammar and syntax of the pronoun.
For roots and suffixes use the *Pupil Teacher's English Note-book* (Thomas Nelson and Sons).
4. *Geography.*—Productions and industries of England. Learn these thoroughly. Draw a map, inserting all towns where manufactures, etc., are carried on, and ascertain why certain industries are located in certain towns.
5. *History.*—The Saxon period—up to the battle of Hastings.
Chief points—The character of the Saxon invasion; the seven kingdoms or heptarchy, and how they became three and then one; the introduction of Christianity (*a*) by St. Augustine in the south, (*b*) by Irish missionaries in the north; the Danish invasions; the reign of Alfred, and why he is properly called "great;" Dunstan and his aims; the reign of the Confessor, and how it paved the way for the Norman Conquest; the battle of Hastings; Saxon institutions and government; explanation of such terms as Bretwalda, Witenagemot, folkmoot, shiremoot, hundred, frankpledge, Danelagh and Danegeld, thane, churl, etc.
6. *Arithmetic.*—Learn thoroughly all tables of weights and measures, and the meaning of terms factor, common factor, greatest common factor. Tests of divisibility by 2, 3, 4, etc. Dividing a number into its prime factors. The theory of G.C.M.
7. *Science.*—The units of measurement and how obtained. The metric system.
8. *Music.*—The intervals of the major scale (staff notation and tonic sol-fa).

Test Questions.

1. Write as specimens of copy-setting:—
(*a*) Large hand.—*Autobiographical.*
(*b*) Small hand.—*A bird in the hand is worth two in the bush.*
2. Give in your own words a brief account of the tale in the *Lay.*
3. What is meant by *case?* Explain direct and indirect objective and nominative absolute.
4. Draw a memory map of the east coast of England, marking in capes, bays, and chief river mouths.
5. Why did the Romans come to England, and why did they leave? What traces of their occupation still remain?
6. Multiply 43002073252 by 133112111 in three lines.
Ans. 5724096747950354972.
7. Write the answer to the above in words.
8. Describe any experiments you can to prove that matter is indestructible.

Second Year Course.

1. *Reading.*—Take regular oral practice, and pay great attention to enunciation and modulation.
2. *Penmanship.*—Ten minutes' practice daily from a good model.
3. *Drawing.*—One or two freehand copies per week.
4. *English.*—Goldsmith's *Traveller,* lines 99–144.
The author has laid down the general laws (81–98) that each country possesses its own advantages, and that every state, by idealising some particular good, produces a corresponding and special evil. He now proceeds to test his theories by examining the various states he has traversed. The first is Italy. Here the natural conditions are all that a man could desire—a fertile soil, a beautiful climate, unlimited natural productions; but man there has fastened on sensual bliss, and has followed this and wealth so eagerly that when the decline came (owing to the discovery of a sea route to India) it left the country poor and mean. The magnificence of the Middle Ages was not real and lasting; what appeared to be a good was really an ill.
Prepare carefully the grammar and syntax of the verb, paying especial attention to mood, auxiliary and defective verbs, voice. The gerund and participles. Fifteen roots and meanings per week.
5. *History.*—James the Second and William the Third.
Chief points—James the Second, his title to the throne; the rebellion of Argyle and Monmouth; the attempts to restore Catholicism; the Declarations of Indulgence; the Trial of the Seven Bishops.
The *Revolution.* This is of the greatest importance. It proved an opportunity of settling by the Bill of Rights all the points which had been in dispute between monarch and people; it initiated a government by Parliament and by Cabinet, and many other institutions—for example, National Debt, Bank of England, standing army, appropriation of supplies, etc. This must be carefully studied.
William the Third. Reduction of Ireland and Scotland. Important legislation. William's foreign policy, which was, to curb at all costs the growing power of Louis the Fourteenth.
6. *Geography.*—Africa. The British colonies in Africa. This will need very thorough preparation. Tabulate them under these heads—(*a*) area, (*b*) population, (*c*) products, (*d*) imports and exports, (*e*) towns, (*f*) method of government.
7. *Arithmetic.*—Averages and percentages.
In working the latter, be careful to reckon *per cent.*—that is, on 100. For instance, in the following—A sold a horse to B at a gain of 10 per cent., B to C at a gain of 10 per cent. What is the total gain?—the answer is not 20. Take A's buying price as 100; then he sells for 110. B sells to gain 10 *per cent.*—that is, ten on every hundred. On 110 the gain would be 11, and the total would be 21.
8. *Science.*—Elementary properties, etc., of iron, mercury, water, and carbon dioxide. Prepare notes as suggested last month.
9. *Euclid.*—Props. 41–44, with four deductions per week.
10. *Algebra.*—Harder fractions. Chapter xxviii., Hall and Knight.
11. *Music.*—Divisions of a pulse into halves, quarters, thirds, etc., and transposition of time.

OUR CERTIFICATE COURSE FOR 1904.

BY GEORGE COLLAR, B.A., B.SC.,

Head-master of the Stockwell Pupil Teachers' School.

THE syllabus has now been amply covered, and a good deal of revision has been done. It is advisable to keep the month of June entirely for revision; and to assist the student by indicating which points require most attention, our plan has always been to set an examination in June which should be attempted under conditions as nearly as possible resembling those under which the Government examination is held. Most of these papers will probably be worked in the evening, but the time taken for each should be the time allowed by the directions at the top, which are the same as those given in the actual Certificate Examination. No text-books should be consulted during the test or after seeing the questions; in fact, it is best not to look at the questions in any one subject until you sit down to answer them. In order to make this test afford as much practice as possible for the actual examination, it is advisable to fill in the heading to each paper before beginning the questions. Fill up these particulars and lose no time. Then read the instructions, noting how many questions you may attempt, which questions are compulsory, and any special methods you must adopt. A careful perusal of all the questions is necessary, not only when a choice is allowed, so that you may select those you can answer best, but even when all have to be answered; for then the student often gets a general idea of the lines on which the examiner wants the answers to run, and may sometimes pick up bits of information in one question which will help in answering another. Unless you are told to answer the questions in the order in which they are set, it is best to begin with those you can answer best. Examination candidates sometimes begin with a difficult question, and spend so much time in ineffectual attempts to solve it that they have none left for questions that are easily within their powers; whereas, if they had attempted the easy ones first, they would not only have had some completed answers to show at the end of the examination, but their success in dealing with these would have given them a confidence which is a great help in the rest of the examination.

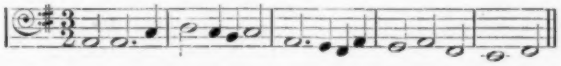
MUSIC.

(One hour.)

Candidates may answer not more than ten questions, which may be taken from either of the following sets, but not from both.

Staff Notation.

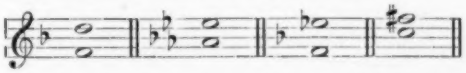
1. Write the following in the treble clef (with the proper key signature) to sound two octaves higher.



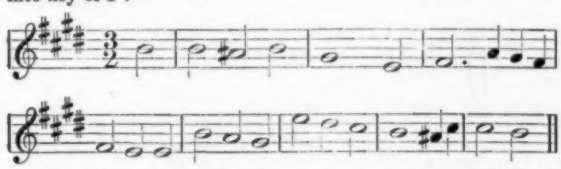
2. Write, in the treble clef, one octave of the scales of A flat major and B major, marking the necessary sharps and flats before the notes and *not* as a signature.

3. Arrange the following sharps and flats in the usual order and position, and state for what major keys they stand :—

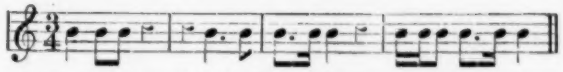
4. State the names of the following intervals :—



5. Transpose the following a minor second higher—namely, into key of F :—

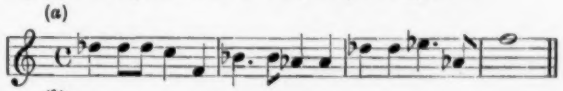


6. Transcribe the following from $\frac{3}{4}$ into $\frac{6}{8}$ time, doubling the value of each note and rest :—

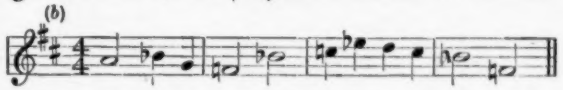


7. State the key of each of the following passages. Each passage is to be regarded as in one major key throughout.

(*a*)



(*b*)

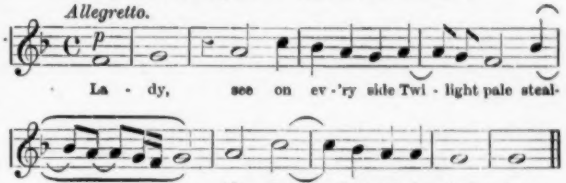


8. State the meaning of the following :—M. 84, *Più mosso, allegretto, rallentando, ad lib.*

9. Write two bars in each of the following times :—$\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, and $\frac{4}{4}$.

10. Write the following in the tonic sol-fa notation :—

Allegretto.



Tonic Sol-fa Notation.

1. What tones in the relative minor correspond to the following passage in the major ?—

Major :— **d m r s f d m r f s m s, l, t, d**

Relative minor :—

2. What is the name (*a*) for *doh* sharp, (*b*) for *lah* flat, (*c*) for *fah* sharp ? (*d*) Rewrite the following in the "imperfect" method :—

Doh is C. f. F. C. t.

d : m r 'd m f t, r 'm l t d'

3. Rewrite the following in the "first sharp" key—that is, regard the first note as *ray*, and so on :—

l fe r s fe d' t l s fe m re m

4. Write two measures each of the following :—two pulse, four pulse, six pulse.

5. State the meaning of the following :—M. 84, *Più mosso, allegretto, rallentando, ad lib.*

6. Write the tonic sol-fa names that stand for the following major mode scale degrees :—

(*a*) Tonic, (*b*) dominant, (*c*) subdominant, (*d*) mediant, (*e*) submediant, (*f*) supertonic.

7. Write figures over the following notes to show the value of each note and rest :—

{| s.,m:d. | f :- | : | m :-.f | s.f,m:f.t, | d : ‖

8. Rewrite the following, doubling the value of each note and rest :—

{| s :-.s,f | m.,r:d.t, | d .r:m | r,m.f:m. ‖

9. Write in sol-fa notation the melody of "God save the King."

10. Write the following passage in the staff notation :—

KEY G.

{.s, | m :-.r | d,.t,:d,.m | s :-|-:-.-.m | d :-.d | d,.t,:d.f | m :-|-:d.m.s}

{| d' :-|1.1,:1,.r.f | 1 :-|f.f:m.r | s :-|d' :-| 1 :-|s :-|d :-|-: ‖

THEORY OF TEACHING.

(Two and a half hours. Answer eight questions.)

1. (*a*) What facts should be recorded in the admission register, and in what circumstances may a name be removed from it, or be inserted in it a second time ?

(*b*) What do you mean by the *closing* of a class register for the morning or afternoon session ? What acts of carelessness on the part of teachers and scholars should be guarded against on these occasions ?

2. Describe Locke's or Mulhaüser's method of teaching writing.

3. Distinguish between "articulation," "emphasis," and "pronunciation." What methods should you adopt with a reading class to ensure that these shall be respectively "clear," "just," and "correct"?

4. Write notes of a lesson on *one* of the following:—
(1.) The war in the Far East.
(2.) Personal pronouns.
(3.) The Anglo-French Treaty.
(4.) A paraffin lamp.

5. How can you appeal to the eye in teaching division of fractions? Why should fractions be taught before proportion?

6. By what mechanical aids may addition and subtraction be taught to young children?

7. To what practical purpose would you put a school museum? and how would you set about providing one?

8. In what various ways are children generally rewarded for good conduct and for proficiency in their studies? Say what kinds of reward appear to you to be legitimate, and what kinds most open to objection.

9. How far can the teaching of English grammar be made to bear practically upon the oral answering and written exercises of the children?

10. In what order would you arrange reading, writing, and arithmetic on the time-table, and why? Under what conditions is it advisable for all the classes to be working the same subjects at the same hours?

11. Distinguish between "recreation" and "physical exercise." Give a sketch of a day's drill for scholars ten years of age.

12. What steps would you take to utilise to the full the children's "self-activity"?

English Language and Literature.

(Three hours allowed. Answer two questions from Section I., and one from each of the others.)

Section I.

1. Describe the character of King Henry the Fifth as represented in Shakespeare's play, pointing out and illustrating by references (*a*) its development, (*b*) its unity, and (*c*) the chief traits in it which are enforced by comparison with contrasted characters.

2. Comment on the following passages:—

(*a*) "There's nought in France
That can be with a nimble galliard won."
(*b*) "The law Salique that they have in France."
(*c*) "He hath stolen a pax, and hanged must a' be."
(*d*) "'Tis a hooded valour, and when it appears it will bate."
(*e*) "From Ireland coming,
Bringing rebellion broached on his sword."
(*f*) "Think not upon the fault
My father made in compassing the crown."
(*g*) "A mighty whiffler 'fore the king."

3. Point out some of the difficulties of dramatising war, and consider how far and by what means Shakespeare has overcome these difficulties in *Henry V.* or other plays; *or*

In what respects does Shakespeare depart from historical accuracy in this play?

Section II.

1. Give an account of the part played by *three* of the following characters in *Kenilworth*:—Wayland, Giles Gosling, Sir Walter Raleigh, Tressilian, Alasco.

2. Give an account of *either* the journey of Amy Robsart from Cumnor to Kenilworth, *or* of the interview between Queen Elizabeth and Amy Robsart.

Section III.

1. Describe in your own words *either* Sir Roger at the Assizes, *or* Sir Roger at Vauxhall.

2. Give a short account of three of the following:—Tom Touchy, Sir Roger's chaplain, Sir Roger's household servants, Moll White, Captain Sentry.

Section IV.

1. Give the substance of what Dr. Johnson said about Leibnitz, Goldsmith, Garrick, the poems of Ossian.

2. Give an outline of the course taken by Dr. Johnson in his tour to the Hebrides.

Section V.

1. What were the chief characteristics of the poetry of the eighteenth century? Illustrate your answer as far as possible by quotations.

2. Name the authors of any *four* of the following extracts, and show by further quotation or reference to the context that you are acquainted with the poems from which they are taken. (You are not required to annotate the extracts themselves.)

(*a*) "Blow, blow, thou winter wind,
Thou art not so unkind
As man's ingratitude."

(*b*) "Cupid and my Campaspé played
At cards for kisses; Cupid paid."

(*c*) "Last came and last did go
The Pilot of the Galilean lake;
Two massy keys he bore of metals twain—
The golden opes, the iron shuts amain."

(*d*) "Stone walls do not a prison make,
Nor iron bars a cage;
Minds innocent and quiet take
That for a hermitage."

(*e*) "Say, Father Thames—for thou hast seen
Full many a sprightly race,
Disporting on thy margent green,
The paths of pleasure trace—
Who foremost now delight to cleave
With pliant arm thy glassy wave?
The captive linnet which enthral?"

(*f*) "Take her up tenderly,
Lift her with care;
Fashioned so slenderly,
Young and so fair!"

(*g*) "When reposing that night on my pallet of straw
By the wolf-scaring fagot that guarded the slain,
At the dead of the night a sweet vision I saw,
And thrice ere the morning I dreamt it again."

English History.

(Two hours allowed. Answer four questions, not more than one out of each section.)

Section I.

1. (*a*) Say what you know of the Druids. (*b*) What do you know of Cædmon, St. Patrick, Bede?

2. (*a*) Say what you know of the system of local self-government in the time of Alfred. (*b*) What evidences of the Danish invasions now remain?

3. Which English monarchs have not been succeeded by their nearest heirs? Say how the succession was decided in each of these cases.

Section II.

1. Describe the weapons used by soldiers of this country at different periods.

2. What attempts have been made at different times to prevent the accumulation of wealth by the Church, and with what results?

3. (*a*) Give an account of Cromwell's campaign in Ireland. (*b*) What part did the Scotch take in the civil war of Charles the First?

Section III.

1. Where are the following places, and in what way are they connected with English history:—Jumièges, Torres Vedras, Boulogne, Toulon, Walcheren, Chateau Gaillard, Closter Seven, Navarino?

2. (*a*) What circumstances account for the success of the colonists in the War of American Independence?

(*b*) What quarrels have arisen since between England and the United States, and how are such quarrels likely to be prevented in the future?

3. Contrast the characters of Queen Elizabeth and Queen Anne. Which public officers held corresponding posts in the reigns of these two queens?

Section IV.

1. (*a*) What causes enabled England to resist Napoleon successfully while most European nations succumbed?

(*b*) Mention any courses taken by this country during the wars 1793-1815 to which exception has been taken, and say to what extent they are justifiable.

2. Give instances of disputes between the House of Lords and the House of Commons during the last century, and say how they were respectively settled.

3. Discuss Mr. Gladstone's foreign policy, with special reference to affairs in Africa.

Geography.

(Two hours allowed. Answer six questions.)

1. Give three methods of finding the north. Why does not the compass needle point to the true north in this country?

2. Contrast the chief physical features of the western part of North America with those of the eastern.

3. What are the following substances, and where are they obtained:—tapioca, mace, kaolin, guano, opium, camphor, amber, jute?

4. Which parts of the world are rainless, and why?

5. What do you know of the trade winds *or* of the monsoons?

6. In which parts of the world does the sun always set exactly in the west? When does it set in the west in this country, and why does it vary in its setting point?

7. Name twelve important towns that have been named after persons, and state the reason.

8. Give an account of *either* the Canadian Pacific Railway *or* of the Trans-Siberian Railway.

9. Describe the climate and productions of Japan.

10. What is meant by the "yellow peril"? In which parts of the world are race difficulties felt?

11. To what is the importance of the following places due:—Le Havre, Hamburg, Port Arthur, Kimberley, Interlaken, Peshawar?

12. Compare the productions of France with those of Germany.

Arithmetic.

(Three hours allowed. All questions may be answered.)

1. (*a*) Explain the use of "complementary addition."

(*b*) What graphic illustrations would you use in teaching division of fractions?

(*c*) Explain, as to children, the difference between simple and compound interest.

2. Two pits are 25 miles apart. At one the price of coal is 13s. a ton, and at the other 15s. a ton. If the carriage coats 3d. per ton per mile, at what place between the two pits would the price of coal from either pit be the same?

3. Find the compound interest on £750 for three years at 4½ per cent. per annum.

4. Simplify $\frac{\frac{1}{2}-\frac{1}{3}-\frac{1}{7}-\frac{1}{42}-\frac{1}{1407}}{\frac{1}{2}\times\frac{1}{3}\times\frac{1}{7}\times\frac{1}{42}\times\frac{1}{1407}}$.

5. Divide £61, 4s. among 12 men, 17 women, and 26 children in such a way that a man shall receive three times as much as a child, and a woman twice as much as a child

6. A merchant buys 84 gallons of whisky at 16s. 9d. per gallon. He adds water to it, and then makes a profit of ten guineas by selling it at 16s. 6d. a gallon. How much water did he add?

7. In a race of 500 yards A can run at an average rate of 11¾ miles and B of 12½ miles an hour. What start can B give A in a 500 yds. race so that B may win by a yard?

8. At what times between seven and eight are the hands of a clock at right angles?

9. The circumference of a circle is 3·14159 times its diameter. Find the circumference of a bicycle wheel 2 ft. 4½ inches in diameter, and the number of revolutions it will make in going 9 miles.

10. If the interest on £506, 5s. at 5 per cent. be equal to the discount on £514, 13s. 9d. for the same time at 5 per cent., when is the latter sum due?

11. A person invested £7,485 in the purchase of three per cents. at 90 and of three and a quarter per cents. at 97. His total income is £250. How much of each stock did he buy?

12. What is meant by true discount, square root, greatest common measure, mean proportional, and recurring decimal?

Algebra. (Men only.)

(Two hours. Answer all the questions.)

Take ten consecutive examples from the Miscellaneous Exercises at the end of your text-book.

Geometry. (Men only.)

(Two hours. Answer all the questions.)

1. Define parallel straight lines, an equilateral triangle, a rhombus, a plane surface. Prove that equilateral triangles on equal bases are equal in all respects.

2. If a straight line, falling on two other straight lines, make the alternate angles equal to one another, show that the two straight lines are parallel.

3. If P is a point within an angle BAC, show that one, and only one, straight line can be drawn through P and be terminated by AB and AC so as to be bisected at P.

4. If the four sides of a quadrilateral are equal, and one angle is a right angle, show that all the angles are right angles.

If the four sides of a quadrilateral are equal, show that the diagonals bisect each other at right angles.

5. A straight line AB is bisected in C. Show how to find a point D in AB produced such that the rectangle contained by AD.DB may be equal to the square on BC.

6. If two circles touch each other externally, show that the line joining their centres will pass through the point of contact.

If two circles cut each other, show that the line joining their centres (produced if necessary) is at right angles to the common chord, and bisects it.

7. Given a triangle ABC, show how to describe circles with centres A, B, C, so that the circles with centres B and C may touch each other externally, and also touch internally the circle whose centre is A.

English Composition.

(One hour. No candidate may omit this exercise.)

Write a short essay on *one* of the following subjects:—

1. The advantages and dangers to a nation of permitting unrestricted alien immigration.
2. Co-operative societies.
3. On making provision for old age.
4. The relation between a man's work and his recreations.

General Elementary Science.

(Three hours. Not more than 8 questions to be attempted altogether, of which two at least must be taken from Section A (i.), Elementary Physiography.)

A. (i.)—*Elementary Physiography.*

1. What is an oxide? Describe the appearance of some oxides with which you are familiar, and say how you could prove that they contain oxygen.

2. An inverted cup is placed in a fruit tart with plenty of juice. What changes take place in its contents during the cooking and after?

3. Why does the mercury stand at about 30 inches in a barometer tube? What would happen (*a*) if the tube were moved out of the perpendicular; (*b*) if a small hole were drilled in the top of the tube?

4. How could you distinguish a pure liquid, such as water or alcohol, from a mixture of two different liquids?

A. (ii.)—*Advanced Physiography.*

5. What do you mean by the "latent heat of steam"? How could you roughly determine it experimentally, and to what would the errors in your calculations be due?

6. Sodium is a metal which must be kept under paraffin to preserve it from the dampness of the air. How could you determine the specific gravity of a piece of sodium?

7. Describe the production of the rainbow. What limits the amount of the circle we can see?

8. How can you determine the percentage of oxygen in the air? By what method can oxygen be obtained from the air?

9. What do you mean by the "coefficient of linear expansion" of a solid? How could you determine it in the case of iron? and what is the relation between the coefficient of linear expansion and the coefficient of cubic expansion?

B.—*Elementary Biology.*

1. Describe the amœba or some other of the lower forms of animal life with which you are acquainted.

2. Describe the structure and action of the kidney.

3. Compare the growth of a carrot in the first year with its growth in the second.

4. What are the parts of the flower of a stock or pea, and what is the function of each?

5. Describe the digestive organs of a pigeon or other bird.

C.—*Domestic Science and Hygiene.*

1. Describe some of the best forms of exercise, and say what are their advantages and disadvantages.

2. What are the food-stuffs to be found in a suet dumpling? In what way is each digested?

3. What is flannelette? What are its advantages and disadvantages compared with calico and flannel?

4. Name some of the chief substances used as disinfectants, and say how they act.

5. What are the advantages and disadvantages of the following beverages:—wine, beer, cocoa, and effervescent lemonade?

6. Describe the method of making beef-tea, and say when and how it should be used.

Next month we shall begin the course for 1905, and as it is important that all who take the work should follow the *whole* course, we trust that our readers will advise their friends to begin with the July number. The first paper, moreover, is particularly important, because it will deal with the syllabus and text-books.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this Number.**

PHYSIOGRAPHY.

(STAGES 2 AND 3.)

THE METAMORPHIC ROCKS.

The study of the metamorphic rocks always presents much difficulty to students of physiography. This is not to be wondered at, since the subject is a most complicated one, and authorities differ very much in their views on the changes which have taken place in these rocks. It is impossible in the space at our disposal to review the many controversies which have taken place and the divergent opinions which have been expressed in connection with this subject.

A short account, however, of these rocks and a classified table will be useful. Amongst the metamorphic rocks we include those in which new crystalline substances or new structures have appeared as the result of earth movements, pressure, or heat. We do not here include consolidated rocks such as some of the sandstones, which have been cemented together by the infiltration of siliceous, calcareous, or ferruginous materials. These rocks still retain most of their original characteristic features, and are known as *altered rocks*. We cannot, however, draw a sharp line between the altered rocks and the truly metamorphic rocks, as they pass gradually from one class to the other.

We speak of different classes of metamorphism in different ways, according to the way in which we look at them. If we are considering the *agencies* which bring about the various changes, we speak of *hydro-metamorphism*, *thermo-metamorphism*, or *dynamo-metamorphism*, according as the changes have been brought about by the agency of water, heat, or mechanical motion and pressure; if we are considering the *method* in which the agencies work, we speak of *chemical* or *mechanical metamorphism*; if we are considering the *effects*, we speak of the metamorphism as *constitutional*, *textural*, or *structural*; whilst if we are viewing the *extent* of the areas over which the changes have taken place, we speak of *contact* or *local metamorphism*, or of *regional metamorphism*.

Hydro-metamorphism.—Water plays a very great part amongst metamorphic agents. It appears to be the chief agent where changes in chemical constitution are produced. Its action is intensified by heat and pressure; hence it also plays an important part in the changes which are classed as thermal and dynamical. Practically all the constituents of rocks are soluble to a slight extent in water. The solubilities of many minerals are, however, much greater in rain water than in pure water, because of the carbonic acid contained in the rain water. Rottenstone is the result of the disintegration of limestones by rain water. When water is subjected to such great pressures and high temperatures as it is at considerable depths below the earth's surface, it becomes a much more powerful solvent, and is then able to dissolve some of the minerals from the rocks and carry them off and deposit them elsewhere, as in the fissures in the rocks above.

There seems to be little doubt that many of the metalliferous veins or lodes found in some districts owe their origin to water acting in this way.

Thermo-metamorphism.—When changes are brought about in neighbouring rocks by the injection of molten rock, as in the formation of dykes and bosses, the changes are chiefly thermal changes and local, giving us the kind of changes known as contact metamorphism. Around these dykes and bosses clays and shales are baked until they become so hard that they cannot be scratched by a knife, and resemble dark-coloured flint, breaking with a conchoidal fracture, and are then known as *Lydian stone* and *porcellanite*. Under the same conditions sandstones are changed into a *quartzite*, and *marbles* are formed from chalk and limestone. In many cases the intruded rock itself becomes altered to a light-coloured, easily-broken rock known as *white trap*. Where the mass of molten rock is very great, as in the case of the enormous granite bosses of the English Lake District, Scotland, and the west of Ireland, the effects of the great heat given out may be observed for several miles, the extent of the alteration produced decreasing as the distance from the boss increases.

Many of the altered rocks show distinct bedding and cleavage planes, but these are the same as those they possessed before the metamorphic changes took place. In this way some mica schists and some gneisses have been produced.

Dynamo-metamorphism.—In cases where rocks are subjected to great lateral pressure, due to the creep or movement of the earth's crust, extensive changes may take place in the characters of the rocks. New cleavage planes appear which generally do not coincide in direction with the original bedding planes which the rocks may have previously possessed. Even homogeneous substances like clays are changed, and develop a structure called cleavage, and can then be split into sheets, and are known as *slates*. Shales are altered in much the same way, and the slates, again, cleave in parallel sheets. In cases where the rock masses subjected to lateral pressure are varied in composition and structure, they yield unevenly to the crust creep, and the planes along which they split become irregular. Where the creep is extended, portions of the harder rocks may be broken up and spread out in layers in the softer material around them, forming *crush-breccias* and *crush-spreads*. Crush-spreads thus formed can be distinguished from beds deposited by water by their lenticular form. The rocks which split into irregular layers when broken are spoken of as *foliated* rocks. The different layers are usually composed of different minerals, and, as a rule, are not parallel plates, but lenticular sheets of crystalline structure dying away gradually to thin edges all round. The planes along which they split are called the *planes of schistosity*.

The foliated rocks may be divided into *gneisses* and *schists*. The gneisses are those foliated rocks possessing a crystalline structure similar to that of granite, but differing from it in that it is foliated. Hence, according to their mineral composition, we speak of granite gneisses, diorite gneisses, syenite gneisses, etc. The schists have a fine-grained structure, and split into irregular lenticular sheets. They resemble slates, shales, and flagstones in appearance, but, unlike them, have a foliated structure. The main varieties, named after their characteristic minerals, are mica schist, quartz schist, garnet schist, and hornblende schist.

The gneisses and schists may be further divided into two structural groups—(1) the *stratoidal group*, in which the various layers are parallel or nearly so; (2) the *phacoidal* or *lenticular group*, showing a distinct lenticular structure.

The banded gneisses belong to the stratoidal group, and in them the layers are generally easily distinguished by differences in texture, composition, and colour. The flaggy schists belong to the same group.

The phacoidal group embraces by far the greater portion of the metamorphic rocks. In some cases the lenticles are very distinct, and then we get the *augen gneisses* and *augen schists*, named after the eyelike structure of the lenticles. (German, *augen*, "eyes.")

In some cases the layers around the lenticles are very well marked, like streams around them, and exhibit a stringy appearance. In these cases they are known as *flaser gneisses* and *flaser schists*.

The following particulars of the chief altered and metamorphic rocks will be useful when examining specimens.

Quartzite.—A compact rock composed of sand grains cemented

together by deposited silica. In colour it varies from white to red and brown. It is very hard, and breaks with a lustrous fracture. In microscopic sections the sand grains can be easily distinguished from the deposited silica; and in cases where the rock has been deformed by metamorphic agencies, this is easily detected by the distorted crystals, especially when they are viewed between crossed nicols.

Lydian Stone.—A black or brownish rock formed from a carboniferous shale. It is very hard and fine-grained, and shows a certain amount of iridescence when turned about in the hand.

Porcellanite.—A flint-hard rock of pale colour formed by the heating of clays, shales, or tuffs. It breaks with a conchoidal fracture, and the fractured surfaces are dull like those of porcelain.

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

Electrolytic Preparation of Hydroxylamine.—Hydroxylamine may be prepared by reduction of nitric acid by electrolysis in sulphuric acid solution. The electrolytic cell is divided by a porous partition, and 50 per cent. sulphuric acid is placed in both compartments. The anode is lead, and the cathode amalgamated lead; 50 per cent. nitric acid, a drop at a time, is added to the cathode portion of the cell, and the temperature kept down below 20° by cooling coils during electrolysis. A current of ·6 to 1·2 ampères per square centimetre is suitable. The hydroxylamine can be separated by the usual methods.

Actinium Emanation.—André Debierne, in the *Compt. Rend.*, 1904, p. 138, gives an account of the emanation from actinium. The energy of the emanation was measured by its power of ionising a gas, and it was found that the ionising power decreased gradually from the moment when it was produced. Plotting the logarithms of the intensities of ionisation as abscissæ and the time which had passed since its production as ordinates, a straight line was obtained, and the constant of this was found to be 3·9 seconds. The actinium emanation is capable of producing radio-activity in other substances, and its power of doing this does not decay so quickly as the ionising power. From this it would appear that the actinium emanation possesses two sources of energy. The radio-activity induced by actinium decreases quite regularly. It decays to half its initial value in forty minutes from the time of its production.

The Radium Emanation and its Heating Effect.—E. Rutherford and H. T. Barnes have conducted a series of experiments to determine the connection between the radio-activity of radium and the heat emitted. In their experiments they employed platinum thermometers and a differential galvanometer. The emanation was separated from the radium by heating, and was collected in a tube surrounded by a liquid air jacket. The heating effect of the radium fell gradually for three hours, when it reached a minimum, having decreased about 30 per cent. of its initial value. It then gradually rose, and in about a month attained its original value. Changes occurred in the emanation tube at the same time, and at such a rate that the sum of the two heating effects of the radium and its emanation remained constant. From their results they concluded that about 75 per cent. of the heat is given out by the emanation and the active matter it produces, and is not due to radium directly. The active matter produced by the emanation is named emanation X.

In dealing with the emanation, it was found that the decrease in the heating effect changed at about the same rate as that of the radio-activity, and this would indicate that the expulsion of the α-rays is accompanied by the emission of heat. The heating effect of the radium had decreased to 45 per cent. of the original in ten minutes after the removal of the emanation, and the further decay from this point to the minimum point is probably due to the decay of activity of the remaining emanation X. The curves indicate that there are three distinct changes in the emanation X. In the first, one-half of the matter is transformed in three minutes; in the second, one-half in thirty-four minutes; and in the third, one-half in twenty-eight minutes. The first change is accompanied by the emission of α-rays, the second is not, and the third is accompanied by α, β, and γ rays. The heating effect seems to be divided up in the following proportions: radium gives 25 per cent., the emanation and the first change to emanation X gives 41 per cent., and the second and third changes give about 34 per cent. It is calculated that the energy liberated by 1 c.c. of the emanation would be from $1{\cdot}25 \times 10^8$ to $1{\cdot}25 \times 10^9$ gram calories per hour, and 1 gram can radiate an enormous amount of energy lying between 2×10^9 and 2×10^{10} gram calories.

The Gases given off by Radium Bromide.—Professors Dewar and Curie have examined the gases given off by radium bromide. Four hundred milligrams of pure dry radium bromide were left for three months in connection with a Geissler tube exhausted of air, and it was found that a certain amount of gas was evolved which measured 3 c.c. at atmospheric pressure. This gas proved to be hydrogen, and was probably due to a small quantity of water accidentally introduced into the tube along with the salt. The same radium bromide was then heated to fusion in a small quartz flask, and the evolved gases removed by a mercury pump. The greater part of the emanation and the less volatile gases were condensed in three small U-tubes surrounded by liquid air. The remainder of the gas was collected over mercury, and measured 2·6 c.c. at atmospheric pressure. It was self-luminous and radio-active. A photograph of its spectrum was obtained by giving an exposure of three days with a quartz photographic spectroscope. The spectrum was a discontinuous one, showing three distinct lines coincident with the three principal bands of nitrogen—3800, 3580, and 3370. During these three days the glass became coloured intensely violet, and half the gas was absorbed. The spark spectrum of the gas also showed only the bands characteristic of nitrogen, even after condensing the nitrogen by means of liquid hydrogen. The quartz tube containing the fused radium bromide deprived of all occluded gases was sealed and examined spectroscopically twenty days later by Deslandres, with the result that the gas in the tube gave the entire spectrum of helium, there being no lines of any other gas, even after an exposure of three hours.

Reduction Effects of Alternating Currents.—If an alternating current is passed through a saline solution, either the dissolved salts are more or less completely reduced, or the electrodes are dissolved. The reduction of the salts seems to depend on the frequency and density of the current, and also on the nature of the electrodes, those made from easily oxidisable metals being most effective. When the current density is great, only the salts are affected and reduced, whereas when the density is low the electrodes only are oxidised. In solutions of alkali nitrates very little reduction is produced with carbon, iron, or copper electrodes, but with cadmium or zinc electrodes the reduction to nitrites is almost quantitative. Under somewhat similar suitable conditions cuprous salts are formed from cupric salts, mercurous salts from mercuric, chromium salts from chromates, while nitrobenzene is converted into an aniline salt.

The Molecular Weight of Solid Phosphorus Hydride has been determined by Rudolf Schenck and Ernst Buck (*Ber.*, 1904, p. 37). This has been done by the cryoscopic method, yellow phosphorus being used as solvent. The molecular depression of the yellow phosphorus was determined by using naphthalene as solute, the value obtained being 332. The results point to the formula $P_{12}H_6$.

Bursting Pressures of Glass Tubing.—Walter P. Bradley and A. W. Browne (*Jour. Physical Chem.*, 1904, p. 8) describe their experiments on the bursting pressures of glass tubes. It is found that generally the bursting pressure varies directly as the thickness of the wall and inversely as the bore. In these experiments, therefore, the values of the expression $\frac{PB}{W}$ were compared, where P is the bursting pressure, B the bore, and W the thickness. Jena glass and soft glass gave the highest results, and Bohemian glass the lowest. Lead glass in particular proved to be very trustworthy, the most erratic tube being only 15 per cent. below the normal strength. The experiments showed that the strength of a tube depends on its previous history; for example, a particular tube once tested almost to the limit of its strength, say to 100 atmospheres, would not stand the same pressure again, but would probably burst at very low pressures.

Molecular Weight Determinations.—Ernst Beckmann (*Zeit. Physikal Chem.*, 1903, p. 46) finds that pure methylene iodide has two freezing points—4° C. and 4·7° C. It would, therefore, appear that this substance is capable of crystallising in two forms. The more stable form is that which melts at 4·7° C.; and Beckmann, by using solutes of known molecular weight, has found that the mean depression constant for this form is 144, while for the other it is 137. By means of methylene iodide the molecular weights of sulphur, selenium, phosphorus, and iodine have been determined, and the values obtained point to the formulæ S_8, Se_{10}, P_4, I_2. In a similar way, dissolving aluminium bromide in bromine gave the formula Al_2Br_6 for this compound. The elevation constant for bromine was taken as 52, and this was obtained by using tetrabrommethane as solute. Using bromine as solvent, the following formulæ—$SnBr_4$, $SbBr_5$, and $AsBr_3$—were obtained for stannic bromide, antimony pentabromide, and arsenic tribromide respectively.

THEORETICAL MECHANICS.

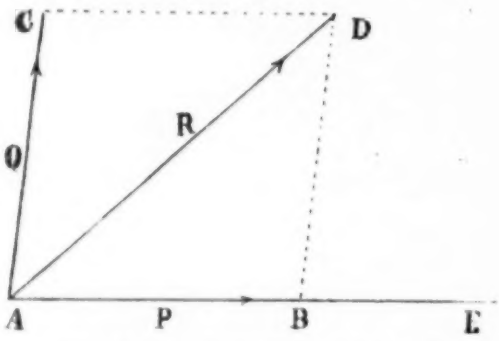
(ADVANCED AND HONOURS STAGES.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mechanics, etc., Morley College, London; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Forces acting at a Point.—The resultant of two or more forces acting at a point may be obtained either by graphical methods or by calculation.

Let P and Q denote two forces acting at a point A. Then we may to any convenient scale measure off a distance AB to denote the magnitude of P, and similarly a distance AC = Q. The resultant, R, is given in magnitude and direction by the diagonal of a parallelogram having AB and AC for two of its sides. The



same result would obviously be obtained by using the triangle ABD. The force equal in magnitude but opposite in direction to R forms what is called the *equilibrant* of the two forces P and Q, and the three forces P, Q, and R reversed would form a system in equilibrium. Let α, β, and γ denote the angles ADB, DAB, and ABD respectively; then from the well-known sine rule we obtain the relation :—

$$P : Q : R = \sin\alpha : \sin\beta : \sin\gamma.$$

It will be noticed that the usual data for the solution of a triangle is all that is required.

Thus if, as in the preceding case, the data includes the magnitudes of two forces and the angle between them, then the magnitude of the resultant may be obtained from the formula

$$R^2 = P^2 + Q^2 - 2PQ\cos\theta \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

It will be evident from the diagram that the angle θ in (1) denotes the angle ABD, and is therefore the supplement of the angle between the two given forces. Hence, when the given angle is acute, we obtain $R^2 = P^2 + Q^2 + 2PQ\cos\theta$; and when it is an obtuse angle, $R^2 = P^2 + Q^2 - 2PQ\cos\theta$.

Instead of the preceding, we might use the formula for the solution of a triangle, given two sides and included angle—namely,

$$\tan\tfrac{1}{2}(A - B) = \frac{a - b}{a + b}\cot\tfrac{1}{2}C,$$

in which a and b denote the two given sides and C the included angle.

Having found the two angles A and B, then the magnitude of the resultant would be the remaining side c, and this could be obtained by an application of the sine rule.

The preceding process of finding the resultant of two given forces is merely a simple case of *vector addition*. The method therefore applies to other vectors, such as velocities, accelerations, displacements, etc.

Ex. 1. Enunciate the triangle of forces. Show how to find by a graphical construction the angle at which two forces, each equal to 50 lbs. weight, must act at a point that they may have a resultant equal to 75 lbs. weight. (Inter. Sci., 1900.)

At any point A draw an indefinite line AE, and mark off AB on any convenient scale equal to 50 units. With B as centre, and radius AB, describe an arc of a circle; and with A as centre, and a radius of 75 units, describe another arc intersecting the former in D. Join D to A. Then EBD is the angle required. Its magnitude may be ascertained to be nearly 83° by using a protractor.

The angle may be obtained with greater accuracy by calculation, the graphic method forming a rough check on the result.

Using the formula $\cos B = \dfrac{a^2 + c^2 - b^2}{2ac}$, then, by substituting the given values, we obtain

$$\cos B = \frac{50^2 + 50^2 - 75^2}{2 \times 50^2} = -0{\cdot}125.$$

$$\therefore 180° - B = 82° 50'.$$

Thus the angle between the two given forces is 82° 50′.

Instead of the preceding, any of the well-known formulæ for the solution of a triangle when three sides are known could be used.

$$\text{Thus } \tan\frac{B}{2} = \sqrt{\frac{(s - a)(s - c)}{s(s - b)}},$$

where s denotes half the sum of the three sides a, b, c of the triangle. Substituting the given values, then

$$\tan\frac{B}{2} = \sqrt{\frac{(37{\cdot}5)^2}{87{\cdot}5 \times 12{\cdot}5}} = 1{\cdot}133.$$

$$\therefore \frac{B}{2} = 48° 35', \text{ and } B = 97° 10'.$$

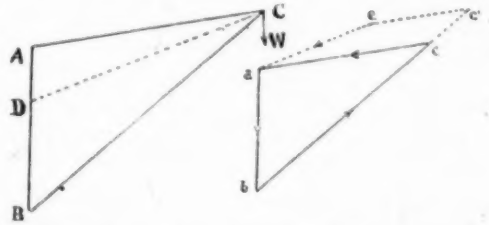
Hence the angle between the two given forces is 180° − 97° 10′ = 82° 50′.

A familiar example of the triangle of forces is furnished by an ordinary crane. The structure may be taken to consist of three bars or members—AB, BC, and CA.

When a load W is suspended from C, the forces must (since the structure is hinged) act in a longitudinal direction, and there will be a certain push or pull in each of the three members.

Three forces act at C—namely, the weight W and the forces in the bars BC and CA. Of these the former is known both in magnitude and direction, and the two latter in direction; hence the triangle of forces can be drawn as follows :—

Make *ab* on any convenient scale to denote the magnitude of W, and draw *ac* and *bc* parallel to AC and BC respectively, inter-



secting at *c*. The three forces acting at C form a system of forces in equilibrium, and the *nature* of the stresses in the bars BC and AC may be obtained by reading the sides of the triangle *abc* in order. It will also be obvious that if AB be assumed to denote the weight W, then the sides BC and CA to the same scale denote the magnitudes of the stresses in BC and CA respectively.

Usually there is in a crane a pulley at C, and the preceding construction must be modified to enable the tension of the chain to be taken into account.

Assuming in such a case the tension in the chain to be the same on both sides of the pulley, then the polygon for the four forces acting at C may be drawn when the direction of the chain, such as the line CD, is known.

Thus, draw *ea* parallel to CD and *ab* vertical, and make each equal to W. Then lines parallel to AC and BC will determine by their point of intersection *c'* the lines *bc'* and *ec'*, denoting the stresses in BC and CA respectively.

Ex. 2. Draw a triangle ABC, with AB vertical and A above B, to represent two bars AC, BC freely jointed at C and attached at A and B to points of a wall which are in the same vertical line. A given weight being suspended from C, determine the natures and magnitudes of the stresses in AC and BC. (Inter. Sci., 1900.)

Draw the triangle ABC as in the preceding. Let W denote the given weight suspended from C, T the stress in AC, and P the stress in BC. Then from the preceding the stress T is known to be a tensile stress, and P is a compressive stress. If AB denotes the weight W, then to the same scale AC and BC denote the magnitudes of T and P respectively.

$$\text{Hence } \frac{T}{W} = \frac{\sin B}{\sin C}.$$

$$\therefore T = W \sin B \operatorname{cosec} C.$$

$$\text{Similarly, } \frac{P}{W} = \frac{\sin A}{\sin C}.$$

$$\therefore P = W \sin A \operatorname{cosec} C.$$

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Eff'ciency (*ef-fish'en-cy*), *n.*, power of bringing to pass what is wanted; ability to perform; agency.—S. *Utility, effectiveness, capacity.*

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Inter. Sc.—A and B are towns beside a river which runs at the rate of 4 miles an hour. A waterman rows from A to B and back again, and takes 39 minutes more to do it in than if there had been no stream. The next day he does the same with another waterman, with whose help he can row half as fast again, and they are now 8 minutes longer than if there had been no stream. At what rate does the waterman row by himself without any stream? (*Advanced Tutorial Algebra.*)

Let x denote the waterman's rate in still water stated in miles per hour. Then, if d denotes the distance between A and B in miles, the time required to row the distance against the stream is $\frac{d}{x-4}$ hours, and the time with the stream $\frac{d}{x+4}$ hours. Also, the time required for the double distance in still water is $\frac{2d}{x}$ hours.

Hence, by the first part of the question, we have—

$$\frac{d}{x-4}+\frac{d}{x+4}-\frac{2d}{x}=\frac{39}{60}. \quad \ldots\ldots\ldots \quad (1)$$

Similarly, from the latter part of the question, we have—

$$\frac{d}{\frac{3x}{2}-4}+\frac{d}{\frac{3x}{2}+4}-\frac{2d}{\frac{3x}{2}}=\frac{8}{60}. \quad \ldots\ldots\ldots \quad (2)$$

From (1) we have—

$$d\left\{\frac{1}{x-4}+\frac{1}{x+4}-\frac{2}{x}\right\}=\frac{13}{20}.$$

$$\therefore d\left\{\frac{2x}{x^2-16}-\frac{2}{x}\right\}=\frac{13}{20}.$$

$$\therefore \frac{32d}{(x^2-16)x}=\frac{13}{20}.$$

$$\therefore d=\frac{13}{20\times 32}x(x^2-16). \quad \ldots\ldots\ldots \quad (3)$$

From (2) we have—

$$d\left\{\frac{2}{3x-8}+\frac{2}{3x+8}-\frac{4}{3x}\right\}=\frac{8}{60}.$$

$$\therefore 4d\left\{\frac{3x}{9x^2-64}-\frac{1}{3x}\right\}=\frac{8}{60}.$$

$$\therefore d.\frac{64}{(9x^2-64)3x}=\frac{1}{30}.$$

$$\therefore d=\frac{1}{20\times 32}(9x^2-64).x. \quad \ldots\ldots\ldots \quad (4)$$

Equating the values of d obtained in (3) and (4), we have—

$$\frac{13}{20\times 32}(x^2-16)x=\frac{1}{20\times 32}(9x^2-64)x.$$

$$\therefore 13(x^2-16)=9x^2-64.$$

$$\therefore 4x^2=13\times 16-64.$$

$$\therefore x^2=36.$$

The waterman's rate in still water is therefore 6 miles an hour.

Chesterman.—Prove that the equation $\sqrt{\frac{x}{h}}+\sqrt{\frac{y}{k}}=1$ represents a parabola touching the axes at points whose distances from the origin are h and k, and show the line $\frac{x}{a}+\frac{y}{b}=1$ will touch the parabola if $hk-bh-ak=0$. (Cambridge Entrance, 1895.)

Rationalising the given equation, we have—

$$\frac{x}{h}+2\sqrt{\frac{xy}{kh}}+\frac{y}{k}=1,$$

and hence

$$\frac{x^2}{h^2}+\frac{2xy}{hk}+\frac{y^2}{k^2}-\frac{2x}{h}-\frac{2y}{k}+1=4\frac{xy}{hk}.$$

$$\therefore \frac{x^2}{h^2}-\frac{2xy}{hk}+\frac{y^2}{k^2}-\frac{2x}{h}-\frac{2y}{k}+1=0.$$

This is the general equation of the second degree in x and y, and the first three terms form a perfect square $\left(\frac{x}{h}-\frac{y}{k}\right)^2$. Hence it represents a parabola. The x co-ordinates of the points in which the axis of x—that is, the line $y=0$—meets the curve are given by the equation

$$\frac{x^2}{h^2}-\frac{2x}{h}+1=0.$$

Since each of the roots of this equation is equal to h, it follows that the axis of x touches the curve at a point whose distance from the origin is h. Similarly, we may show that the axis of y—that is, the line $x=0$—touches the curve at a point whose distance from the origin is k.

The equation of the given line $\frac{x}{a}+\frac{y}{b}=1$ may be written in the form $y=b-\frac{b}{a}x$. Substituting this value for y in the equation of the curve, the resulting equation gives the x co-ordinates of the points in which the line $\frac{x}{a}+\frac{y}{b}=1$ meets the parabola, and we have then to determine the condition that these points shall be coincident. Thus we have—

$$\left(\frac{x}{h}-\frac{b}{k}+\frac{b}{ak}x\right)^2-2\frac{x}{h}-\frac{2b}{k}+\frac{2b}{ak}x+1=0.$$

$$\therefore \left\{\frac{(ak+bh)x-abh}{ahk}\right\}^2+2\frac{bh-ak}{ahk}x-\frac{2b}{k}+1=0.$$

$$\therefore (ak+bh)^2x^2+2ah\{k(bh-ak)-b(ak+bh)\}x+a^2h^2(b^2-2bk+k^2)=0.$$

This equation has equal roots if

$$a^2h^2\{k(bh-ak)-b(ak+bh)\}^2=a^2h^2(b-k)^2(ak+bh)^2$$

—that is, if

$$k(bh-ak)-b(ak+bh)=(b-k)(ak+bh)$$

—that is, if $\quad hk-bh-ak=0.$

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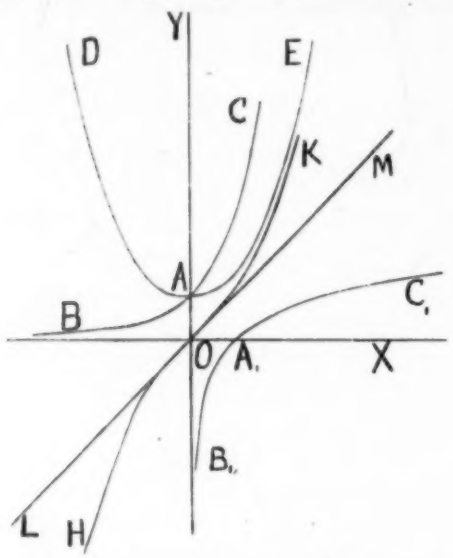
Bike.—Give graphical representations on the same diagram of e^x, $\log x$, $\frac{1}{2}(e^x + e^{-x})$, $\frac{1}{2}(e^x - e^{-x})$. (London B.Sc., 1900.)



In the equation $y = e^x$ it is evident that y does not become negative for any real value of x, that y becomes 0 when $x = -\infty$, and that y increases continuously with x as x increases from $-\infty$ to $+\infty$; also that $y = 1$ when $x = 0$. Hence the curve $y = e^x$ has the form and situation shown by BAC in the figure.

The equation $y = \log x$ can be written in the form $x = e^y$. Hence it is obvious from the foregoing that the curve $y = \log x$ has the form and situation of $A_1B_1C_1$ in the figure.

In the case of $y = \frac{1}{2}(e^x + e^{-x})$ we find that the equation remains unchanged on writing $-x$ for x. Hence the curve represented by this equation is symmetrical with respect to the axis of y. Again, $\frac{dy}{dx} = \frac{1}{2}(e^x - e^{-x})$. Hence the tangent at (0, 1) is parallel to the axis of x. Further, it is evident that no point on the curve lies below this tangent. The curve has therefore the form and situation shown by DAE in the figure.

With regard to the curve represented by $y = \frac{1}{2}(e^x - e^{-x})$, we see that it passes through the origin; and since, on changing the signs of both x and y, the equation remains unaltered, there is symmetry in opposite quadrants. Further, since in this curve we have $\frac{dy}{dx} = \frac{1}{2}(e^x + e^{-x})$, the tangent to the curve at the origin (LOM in the figure) makes an angle of 45° with the axis of x. Now the equation $y = \frac{1}{2}(e^x - e^{-x})$ can be written in the equivalent form

$$y = \tfrac{1}{2}\left\{\left(1 + \frac{x}{1} + \frac{x^2}{\underline{2}} + \frac{x^3}{\underline{3}} + \ldots\right) - \left(1 - \frac{x}{1} + \frac{x^2}{\underline{2}} - \frac{x^3}{\underline{3}} + \ldots\right)\right\}$$
$$= x + \frac{x^3}{\underline{3}} + \frac{x^5}{\underline{5}} + \ldots$$

Hence, for positive values of x, y is positive, and numerically greater than x; and for negative values of x, y is negative, and numerically greater than x. Therefore the portion of the curve above the axis of x lies to the left of the tangent LOM, and the portion below the axis of x lies to the right of LOM.

Further, we have $\frac{d^2y}{dx^2} = \frac{1}{2}(e^x - e^{-x})$; hence $\frac{d^2y}{dx^2}$ changes its sign in passing through the origin. Therefore the origin is a point of inflexion on the curve.

Again, on comparing the two curves $y = \frac{1}{2}(e^x + e^{-x})$ and $y = \frac{1}{2}(e^x - e^{-x})$, we notice that as x increases from 0 to $+\infty$ the values of y in the two equations continuously approach each other. Hence the portions of the two curves which lie in the first quadrant continuously approach each other as x increases.

The curve $y = \frac{1}{2}(e^x - e^{-x})$ has therefore the form and situation shown in the figure by HOK.

A.D.L.—A heavy vertical disc of radius a, with a perfectly rough perimeter, has a light string wrapped many times round it. This string leaves the disc at its highest point, and is then stretched out horizontally and fixed to a point O. If the disc be allowed to fall from this position, show that, if (r, θ) be the polar co-ordinates of the centre of the disc at the time t, then

$$\sqrt{(r^2 - a^2)}\left\{\frac{1}{r}\frac{d}{dt}(r^2\dot{\theta}) - g\cos\theta\right\} + a(\ddot{r} - r\dot{\theta}^2 - g\sin\theta) = 0,$$

O being the pole, and the *horizontal* through O the initial line of polar co-ordinates. (University of Wales, 1903.)

Let C be the centre of the disc, M the mass of the disc, and T the tension of the string at any time t when the co-ordinates of C are r, θ.

Therefore radial acceleration, in OC produced, of centre of disc, equals $\ddot{r} - r\dot{\theta}^2$; and also equals

$$\frac{Mg\sin\theta - T\frac{\sqrt{r^2 - a^2}}{r}}{M} \equiv g\sin\theta - \frac{T}{M}\cdot\frac{\sqrt{r^2 - a^2}}{r}.$$

Hence $\ddot{r} - r\dot{\theta}^2 = g\sin\theta - \frac{T}{M}\cdot\frac{\sqrt{r^2 - a^2}}{r}$.

Transversal acceleration of C at right angles to OC, in direction of increasing θ, equals $\frac{1}{r}\frac{d}{dt}(r^2\dot{\theta})$, and also equals

$$\frac{Mg\cos\theta + T\cdot\frac{a}{r}}{M} \equiv g\cos\theta + \frac{T}{M}\cdot\frac{a}{r}.$$

Hence $\frac{1}{r}\frac{d}{dt}(r^2\dot{\theta}) = g\cos\theta + \frac{T}{M}\cdot\frac{a}{r}$.

Therefore $a(\ddot{r} - r\dot{\theta}^2 - g\sin\theta) = -\frac{T}{M}\cdot\frac{a\sqrt{r^2 - a^2}}{r}$,

and $\sqrt{r^2 - a^2}\left\{\frac{1}{r}\frac{d}{dt}(r^2\dot{\theta}) - g\cos\theta\right\} = \frac{T}{M}\cdot\frac{a\sqrt{r^2 - a^2}}{r}$.

$$\therefore \sqrt{r^2 - a^2}\left\{\frac{1}{r}\frac{d}{dt}(r^2\dot{\theta}) - g\cos\theta\right\} + a(\ddot{r} - r\dot{\theta}^2 - g\sin\theta) = 0.$$

(*A.D.L.* will notice that we have to write "the *horizontal* through O," instead of "the *vertical* through O," in the question as quoted by him, in order to obtain the postulated relation.)

Ralpho.—Prove by means of the remainder theorem that

$$x(y + z)^2 + y(z + x)^2 + z(x + y)^2 - 4xyz \equiv (y + z)(z + x)(x + y).$$

Give all the reasoning, and find without actual division the remainder when $x^3 - 2$ is divided by $(x - 1)(x - 3)$.

Applying the method given in Chrystal's *Introduction to Algebra*, §§ 114 and 115, we denote the function

$$x(y + z)^2 + y(z + x)^2 + z(x + y)^2 - 4xyz$$

by P. Now, considering P as an integral function of the variable x, the remainder, when P is divided by $(x + y)$, is found by replacing x by $(-y)$ throughout P. The result is

$$-y(y + z)^2 + y(z - y)^2 + z(-y + y)^2 + 4y^2z$$

—that is,

$$\{(z - y)^2 - (z + y)^2\}y + 4y^2z, \text{ or } 2z(-2y)y + 4y^2z,$$

which obviously vanishes. Hence P is exactly divisible by $(x + y)$. Similarly P may be shown to be exactly divisible by $(y + z)$ and by $(z + x)$.

Hence, since no one of the three divisors $(x + y)$, $(y + z)$, $(z + x)$ is divisible by either of the other two, P must be exactly divisible by $(y + z)(z + x)(x + y)$; and since P and $(y + z)(z + x)(x + y)$ are each of them of the third degree in x, y, z, the quotient must be independent of x, y, and z. Denoting the quotient by Q, we have therefore

$$x(y + z)^2 + y(z + x)^2 + z(x + y)^2 - 4xyz \equiv Q(y + z)(z + x)(x + y).$$

Since this relation holds for all values of x, y, and z, we may determine Q by taking $x = 1$, $y = 2$, and $z = 3$. Hence we find $Q = 1$. Therefore

$$x(y + z)^2 + y(z + x)^2 + z(x + y)^2 - 4xyz \equiv (y + z)(z + x)(x + y).$$

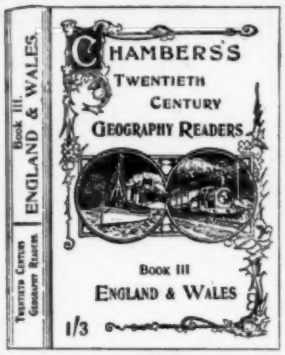
In $(x^3 - 2) \div \{(x - 1)(x - 3)\}$, since the divisor is of the second degree in x and the dividend of the third degree in x, the remainder will be of the first degree in x, and therefore of the form $Ax + B$, where A and B are constants. We may put

$$Ax + B \equiv A(x - 1) + A + B \equiv A(x - 1) + C,$$

where A and C are constants as yet undetermined.

We see, therefore, that there must be an identity of the form

$$x^3 - 2 \equiv \{\phi(x)\}(x - 1)(x - 3) + A(x - 1) + C,$$



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where $\phi(x)$ denotes a function of the first degree in x; and this must hold for the particular values $x = 1$ and $x = 3$.

Since $\phi(1)$ and $\phi(3)$ are both finite, it follows that, if we put $x = 1$ in the identity

$$x^3 - 2 \equiv \{\phi(x)\}(x - 1)(x - 3) + A(x - 1) + C,$$

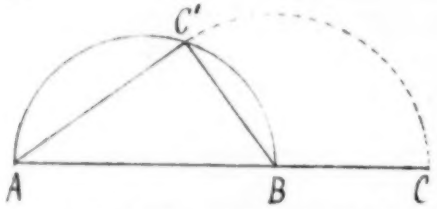
we have $1^3 - 2 = C$. Similarly, if we put $x = 3$ in this identity, we have $3^3 - 2 = A(3 - 1) + C$.

$$\text{Hence } C = 1^3 - 2, \text{ and } A = \frac{(3^3 - 2) - (1^3 - 2)}{3 - 1}.$$

$$\therefore C = -1, \text{ and } A = 13. \text{ Therefore the remainder}$$

$$A(x - 1) + C = 13(x - 1) - 1 = 13x - 14.$$

Dunelm.—Show how to describe a right-angled triangle such that the rectangle contained by the hypotenuse and one of the other sides may be equal to the square on the third side.



Take any line AC and divide it in B so that $AC.CB = AB^2$ (Euclid II. 11).

Since $AC = AB + BC$,

$\therefore (AB + BC)\,BC = AB^2$.

$\therefore AB.BC = AB^2 - BC^2$.

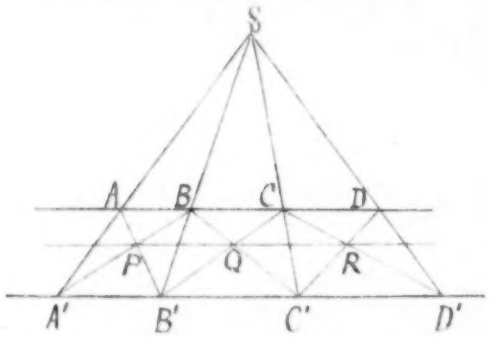
On AB as diameter describe the semicircle AC′B, and place in it the chord $BC' = BC$. Join AC′.

Then AC′B is the required triangle.

For $AB.BC' = AB.BC = AB^2 - BC^2 = AB^2 - BC'^2 = AC'^2$.

Arbela.—There are two parallel straight lines ABCD and A′B′C′D′. From a point S straight lines SAA′, SBB′, SCC′, and SDD′ are drawn. If AB′ and A′B meet at P, BC′ and B′C meet at Q, and CD′ and C′D meet at R, prove that P, Q, and R are collinear.

(Assistant Surveyor of Taxes Examination, Jan. 1904.)



Because the triangles APB, B′PA′ are equiangular,

$\therefore AB : A'B' :: BP : PA'$.

Similarly, $BC : B'C' :: BQ : QC'$.

But $AB : A'B' :: SB : SB' :: BC : B'C'$.

Hence $BP : PA' :: BQ : QC'$.

$\therefore$ PQ is parallel to A′D′.

Similarly, we may prove that QR is parallel to A′D′.

Because PQ is parallel to A′B′, therefore the angles A′B′Q, B′QP are together equal to two right angles. Similarly, the angles D′B′Q, B′QR are together equal to two right angles. But the angles A′B′Q, D′B′Q are together equal to two right angles; therefore the angles B′QP, B′QR are together equal to two right angles.

Hence P, Q, and R are collinear.

Arum.—The density of a solid cone of revolution, height h feet, vertical angle 2α, increases uniformly with the perpendicular with the plane base, being ρ_0 at the base and ρ_1 at the vertex. Find the mass of the cone and its average density ρ_m. If $\rho_1 = 9\rho_0$, show that the average density of the frustrum of height $\frac{h}{2}$ is $\frac{9}{7}\rho_m$.

(Stage V., 1903.)

Let a thin slice of the cone be taken parallel to the base at a distance x from the vertex, and let r denote the radius of the section. Then, if ρ represents the density of the slice, we have $\rho = k(h - x) + \rho_0$, and $\rho_1 = kh + \rho_0$, where k is a constant. Hence $k = \frac{\rho_1 - \rho_0}{h}$.

We have also $r = x \tan\alpha$.

If M be the mass of the cone, we have—

$$M = \int_0^h \pi r^2 \rho dx. \quad \text{Hence}$$

$$M = \int_0^h \pi x^2 \tan^2\alpha \{k(h - x) + \rho_0\} dx.$$

$$\therefore M = \pi \tan^2\alpha \int_0^h \{(kh + \rho_0)x^2 - kx^3\} dx.$$

$$\therefore M = \pi \tan^2\alpha \left[\frac{kh + \rho_0}{3}x^3 - \frac{k}{4}x^4\right]_0^h.$$

$$\therefore M = \pi \tan^2\alpha \left(\frac{kh^4}{3} - \frac{kh^4}{4} + \frac{\rho_0 h^3}{3}\right).$$

$$\therefore M = \frac{\pi \tan^2\alpha\, h^3}{12}(kh + 4\rho_0).$$

But $kh = \frac{\rho_1 - \rho_0}{h}.h = \rho_1 - \rho_0$.

$$\therefore M = \frac{\pi \tan^2\alpha h^3}{12}(\rho_1 - \rho_0 + 4\rho_0).$$

$$\therefore M = \frac{\pi \tan^2\alpha h^3}{12}(\rho_1 + 3\rho_0).$$

Again, if V denote the volume of the cone, we have—

$$V = \int_0^h \pi r^2 dx = \pi \tan^2\alpha \int_0^h x^2 dx.$$

$$\therefore V = \frac{\pi \tan^2\alpha h^3}{3}.$$

Now ρ_m, the average density of the whole cone, is given by

$$\rho_m = \frac{M}{V}. \quad \therefore \rho_m = \frac{\rho_1 + 3\rho_0}{4}.$$

Again, if M_1 represents the mass of the given frustrum, and V_1 its volume, we have—

$$M_1 = \pi \tan^2\alpha \left[\frac{kh + \rho_0}{3}x^3 - \frac{k}{4}x^4\right]_{\frac{h}{2}}^h;$$

$$\text{and } V_1 = \pi \tan^2\alpha \left[\frac{x^3}{3}\right]_{\frac{h}{2}}^h.$$

Hence we find that $M_1 = \frac{\pi \tan^2\alpha h^3}{192}(11kh + 56\rho_0)$;

$$\text{and } V_1 = \tfrac{7}{24}\pi \tan^2\alpha h^3.$$

Therefore the average density of the frustrum

$$\frac{M_1}{V_1} = \frac{11kh + 56\rho_0}{56} = \frac{11(\rho_1 - \rho_0) + 56\rho_0}{56}.$$

$$\therefore \frac{M_1}{V_1} = \frac{11\rho_1 + 45\rho_0}{56}.$$

Now, when $\rho_1 = 9\rho_0$, we have—

$$\frac{M_1}{V_1} = \frac{144\rho_0}{56} = \frac{18}{7}\rho_0.$$

Also $\rho_m = \frac{\rho_1 + 3\rho_0}{4}$ becomes

$$\rho_m = \frac{9\rho_0 + 3\rho_0}{4} = 3\rho_0.$$

Hence the average density of the frustrum of height $\frac{h}{2}$ is to the average density of the whole cone as $\frac{1}{7}^8\rho_0 : 3\rho_0$—that is, as 6 : 7.

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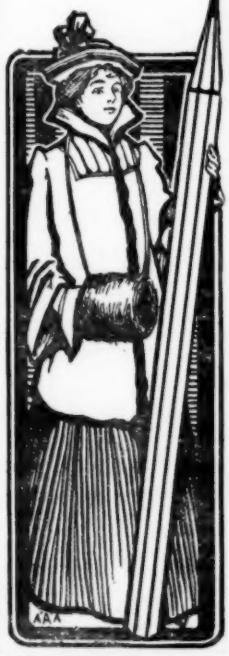

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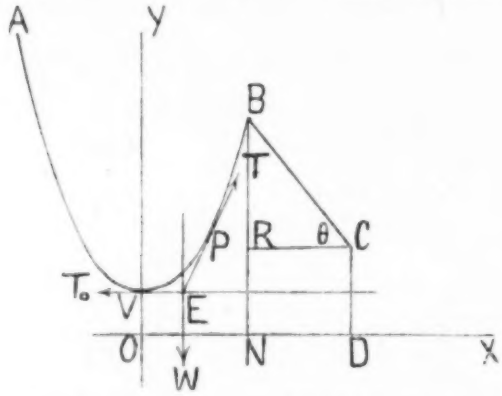
W. H. Hirst.—Prove that if a chain ABCD fastened at A is led over a pulley B so as to rest on a smooth inclined plane BC, the part AB will assume a catenary curve in which the tension at any point P will be the same as at Q at the same level on BC, and deduce the analytical properties of the catenary. (London B.Sc., 1903.)



Referring the curve assumed by AB to rectangular coordinates, V, the lowest point of the curve, being taken as origin, take any point P on the curve and consider the equilibrium of the portion of the chain between V and P. This is at rest under the action of three forces—namely, T_0, the tension at V, acting horizontally along the tangent at V; T, the tension at P, acting along the tangent at P; and W, the weight of VP, acting vertically downwards through the centre of gravity of VP. This last force must therefore pass through E, the point of intersection of the tangents at V and P. Let w be the weight of unit length of the chain, and s the length of the arc VP. Then W, the weight of VP, is equal to ws. The horizontal component of the tension T is obviously equal to the tension T_0, and the vertical component must be equal to the weight of VP—that is, equal to ws.

$$\text{Hence } T = \sqrt{(w^2s^2 + T_0^2)}.$$

Considering a small triangle whose vertex is at P, and whose sides dx, dy, ds are parallel to the directions of the three forces T_0, W, and T, we have from the triangle of forces

$$dx : dy : ds = T_0 : ws : \sqrt{(w^2s^2 + T_0^2)}.$$

$$\text{Hence } dy = \frac{ws\,ds}{\sqrt{(w^2s^2 + T_0^2)}}.$$

Integrating we have $wy = \sqrt{(w^2s^2 + T_0^2)} + C$.

Since $s = 0$ when $y = 0$, we have $C = -T_0$.

Therefore $wy = \sqrt{(w^2s^2 + T_0^2)} - T_0$. . . . . (1)

Now take a length a such that $wa = T_0$, and refer the curve to a new origin 0 on the axis of y distant a below V. Writing $y - c$ for y in equation (1), we obtain $w(y - a) = \sqrt{(w^2s^2 + T_0^2)} - T_0$ as the equation referred to the new origin O; and since $wa = T_0$, this equation reduces to

$$wy = \sqrt{(w^2s^2 + w^2a^2)}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$\text{or } y^2 = s^2 + a^2. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Now we have seen that $\sqrt{(w^2s^2 + T_0^2)}$, or $\sqrt{(w^2s^2 + w^2a^2)}$, is equal to T, the tension at P. Therefore it follows from equation (2) that y is equal to the length of chain whose weight is equal to the tension at P. Hence the tension at any point on AB is equal to the weight of a portion of the chain whose length is equal to the ordinate at that point.

Let θ be the inclination of the plane BC to the horizontal. Then the tension of the chain at B must be equal to w(BC sin θ + CD) = w(BR + CD). But we have shown that the tension at B is equal to wBN, where BN is the ordinate at B. Hence w(BR + CD) = w(BR + RN). Therefore D, the free end of the chain, must just reach the axis of x. It is obvious, therefore, that the tension of the chain at any point P in AB is the same as at Q at the same level on BC.

From the triangle of forces we have shown that

$$\frac{dy}{dx} = \frac{ws}{T_0}.$$

But $T_0 = wa$, and from (3) $s = \sqrt{y^2 - a^2}$;

$$\therefore \frac{dy}{dx} = \frac{w\sqrt{y^2 - a^2}}{wa} = \frac{\sqrt{y^2 - a^2}}{a}.$$

$$\text{Hence } \frac{dy}{\sqrt{y^2 - a^2}} = \frac{dx}{a}.$$

Integrating, and noting that $y = a$ when $x = 0$, we have—

$$\log\left(\frac{y + \sqrt{y^2 - a^2}}{a}\right) = \frac{x}{a}.$$

$$\text{Therefore } \frac{y + \sqrt{y^2 - a^2}}{a} = E^{\frac{x}{a}} \quad . \quad . \quad . \quad . \quad (4)$$

$$\text{Hence } \frac{a}{y + \sqrt{y^2 - a^2}} = E^{-\frac{x}{a}}.$$

$$\text{Therefore } \frac{y - \sqrt{y^2 - a^2}}{a} = E^{-\frac{x}{a}} \quad . \quad . \quad . \quad (5)$$

From (4) and (5) by addition we have—

$$y = \frac{a}{2}\left(E^{\frac{x}{a}} + E^{-\frac{x}{a}}\right).$$

A. D. L.—A gyrostat consists of a flywheel of moment of inertia C pivoted within a rigid enclosing case which is symmetrical about the axis of the flywheel. The whole when turning as a rigid body about a diameter of the flywheel has moment of inertia A, and the centroid of the whole is at the centre of the flywheel. The case is supported on horizontal pivots in line with a diameter of the wheel. While the wheel is rapidly rotating with angular velocity u about its axis, which is inclined at a small angle θ to the vertical, the pivots are carried round in azimuth with angular velocity ω. Show that this motion causes moment of momentum to be generated at the rate $Cu\omega\theta$ about an axis at right angles to the vertical plane containing the axis of rotation, and that therefore the equation of variation of θ is $A\ddot{\theta} + Cu\omega\theta = 0$. Hence show that, according as u and ω have like or opposite signs, the gyrostat will stand stably on the horizontal pivots, or will capsize about them. (University of Wales, 1903.)

For the first part of the question, see *Dynamics of Rotation*, by A. M. Worthington, C.B., M.A., F.R.S. (Longmans, fourth edition, page 162).

A fundamental formula for the rigid dynamics of a body rotating about a principal axis is—

$$\text{Angular acceleration} = \frac{\text{Moment of Forces}}{\text{Moment of inertia about axis of rotation}}.$$

(See Worthington, page 17.)

In the case of the question this becomes

$$\ddot{\theta} = \frac{-Cu\omega\theta}{A},$$

$$\text{or } A\ddot{\theta} + Cu\omega\theta = 0 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

A and C are essentially positive.

(*a*) If the product $u\omega$ is positive, let $\frac{Cu\omega}{A} = n^2$, where n is real; the solution of (1) is

$$\theta = B\cos(nt + \alpha) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

where B and α are constants depending on the conditions when $t = 0$.

Equation (2) indicates that θ will perform oscillations of amplitude B and period $\frac{2\pi}{n}$; that is, the gyrostat will never depart far from its mean position. Then the given motion is stable.

(*b*) If the product $u\omega$ is negative, let $\frac{Cu\omega}{A} = -m^2$, where m is real; the solution of (1) is

$$\theta = Be^{mt} + De^{-mt} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

where B and D are constants depending on initial conditions.

Thus B + D is the value of θ when $t = 0$, say θ_0; and m(B − D) is the value of $\dot{\theta}$ when $t = 0$, say $\dot{\theta}_0$.

Hence (3) becomes

$$\theta = \tfrac{1}{2}(\theta_0 + \dot{\theta}_0/m)e^{mt} + \tfrac{1}{2}(\theta_0 - \dot{\theta}_0/m)e^{-mt} \quad . \quad . \quad . \quad (4)$$

We may fairly take the epoch ($t = 0$) such that $\theta_0 = 0$ and $\dot{\theta}_0$ positive; thus it is seen from (4) that θ increases continuously with t—that is, the gyroscope will capsize.

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Chaos.—In the triangle ABC draw AD to meet BC at right angles in D, BE to meet AC at right angles in E, CF to meet AB at right angles in F. Find the angles of the triangle DEF in terms of the angles of the triangle ABC, and show that the perimeter of the triangle DEF is $a \cos A + b \cos B + c \cos C$.

(Science and Art, Stage II., 1900.)

Let O be the point of intersection of BE and CF. Then, by a well-known deduction from *Euclid*, Book I., the perpendicular AD passes through O.

Because each of the angles OEC, ODC is a right angle, O, E, C, D lie on the circumference of a circle. Therefore the angle ODE is equal to the angle OCE. Similarly, the angle ODF is equal to the angle OBF. Hence the angle FDE is equal to the sum of the angles FCA, EBA.

Now the angles FCA, BAC are together equal to a right angle, and the angles EBA, BAC are together equal to a right angle. Therefore $FDE + 2A = 180°$.

Hence $FDE = 180° - 2A$.

Similarly, $FED = 180° - 2B$.

And $DFE = 180° - 2C$.

Again, since each of the angles OFA, OEA is a right angle, O, F, A, E lie on the circumference of a circle of which OA is a diameter. Hence OA is a diameter of the circle circumscribing the triangle AFE. Now in any triangle the length of any side is equal to the product of the diameter of the circumscribing circle and the sine of the angle opposite that side. Therefore $FE = AO \sin A$. But $AO = AE \sec OAE = AE \operatorname{cosec} C$. And $AE = AB \cos A$. Therefore $FE = AB \cos A \operatorname{cosec} C \sin A = C \cos A \frac{\sin A}{\sin C}$. But $\frac{\sin A}{\sin C} = \frac{a}{c}$.

Therefore $FE = c \cos A \frac{a}{c} = a \cos A$. Similarly we may show that $FD = b \cos B$, and that $DE = c \cos C$.

Therefore $EF + FD + DE = a \cos A + b \cos B + c \cos C$.

Zealander.—Forces equal to 7P, 5P, and 8P acting on a particle are in equilibrium; find the angle between the latter pair of forces.

Take a line AB parallel to the direction of the force 8P and 8 units in length on any convenient scale. Then, if the triangle BCA is drawn so that BC, CA are 7 units and 5 units respectively on the same scale, the three sides AB, BC, CA will represent the three given forces 8P, 7P, and 5P in magnitude and direction.

Hence, to find the angle between the forces 5P and 8P, we have only to measure or otherwise determine the angle BAC.

Denoting the angle BAC by θ, we have—

$$BC^2 = CA^2 + AB^2 - 2CA \cdot AB \cos \theta.$$

$$\therefore 7^2 = 5^2 + 8^2 - 2 \times 5 \times 8 \cos \theta.$$

$$\therefore 80 \cos \theta = 40. \quad \therefore \cos \theta = \tfrac{1}{2}. \quad \text{Hence } \theta = 60°.$$

THE EDITOR'S TABLE.

RECENT EDUCATIONAL WORKS.

R. BRIMLEY JOHNSON.

Consider the Children: A Plea for Better Physical and Moral Education. By Honnor Morten, formerly Member of the London School Board, etc. This little book has an excellent title, and, we doubt not, an excellent purpose. Its execution is thoroughly characteristic of the writer. It contains a great many facts and a great many fallacies. The efficiency of any instrument is the measure of the risk entailed in its use by those who have not the mastery of it, and in the hands of some people facts seem capable of being almost as misleading as statistics. We do not care to trust ourselves to express fully the impression which the book has produced on our mind, but instead we give a characteristic quotation in order to indicate what readers may expect to find in it: "The attitude of the average teacher towards the child is one of antagonism and superior force. The theory commonly acted on is that the Almighty has filled the children with instincts which it is the duty of the pedagogue to drive out with blows. No doubt this aggressive attitude arises largely from the narrow curriculum and confined surroundings of the training college." *Jam satis.*

LONGMANS, GREEN, AND CO.

London Education. By Sidney Webb. This is a most stimulating book to read, and whenever one finds a book on English education stimulating, it goes without saying that the writer is dealing with the future rather than the past. It is only in the future that one can find education unmarred by the miserable sectarian squabbles which have been so heavy a handicap on the schools of our land.

The book now before us deals entirely with the questions of administration which the new state of matters in London has raised. Mr. Webb sees clearly the great opportunity which the metropolis now enjoys for the thorough organisation of its educational machinery, from the infant school to the university and the technical college. The chapter dealing with the university is specially good in a book where all is good, and will repay study by all who have at heart the prosperity of this country. The novel conditions of London University demand for it a type of organisation different from anything which the world has seen, and the lines of progress suggested by the writer are sane, far-reaching, and clearly expressed. Could we secure administrators filled with the same enthusiasm for education, and with the same enlightened understanding of the needs of the metropolitan area, the future of its schools and colleges would be assured.

Short Studies in Education in Scotland. By John Clarke, Lecturer in Education in the University of Aberdeen. The Education Bill for Scotland is now exciting much interest north of the Tweed, and it will not be for lack of aid from speakers and writers if the Government fails to realise what Scotsmen wish to be embodied in the Bill. Mr. Clarke has produced a book which ought to be of some value at the present crisis. He gives a clear and pretty full account of the rise of Scottish schools of various types, and of the changes which were introduced by the Act of 1872, and by subsequent enactments. Indeed, a knowledge of what this book contains, gathered either from the book itself or from some similar source, is necessary to the intelligent discussion of the present conditions, and of the best means of amending what is still amiss or supplying what is wanting. The latter part of the work—the consideration of the best areas for administration—will turn into an argument for or against the Bill according to the views which are held by its authors, but in any case it is worth study as a careful and well-informed review of the requirements of the country.

Education as Adjustment: Educational Theory viewed in the Light of Contemporary Thought. By M. V. O'Shea, Professor of the Science and Art of Education, University of Wisconsin. Adjustment or adaptation to environment is the condition of all organic life, and this modern conception of biology finds a field of application in the social life of man as well as in his merely animal life, though it is necessary to remember that we are no longer using terms in their literal signification when we use those of the material sphere to describe phenomena of a spiritual nature. Adopting this point of view, it is evident that the great function of education is to secure in the individual the most complete adjustment to his whole environment, and the book before us is written with the purpose of deducing the scope and the methods of education in this reference. It is an aspect of education which has not, so far as we are aware, been explicitly considered, though the same thought underlies much of our current discussions of educational matters; hence the work comes with much freshness and suggestiveness.

The present volume does not profess to exhaust the idea in all its ramifications; indeed, the author tells us that it is only the first of a series which he has in preparation. One great advantage of such a work is that it at once takes the teacher to a standpoint whence he can examine his art with somewhat of the scientific instead of the merely empirical attitude of mind, and there is nothing to be more desired than this at the present day. This is the typical attitude among the best American educationists, and it is one which we value the more on account of the prevailing tendency among ourselves—necessary, perhaps, but none the less regrettable—to concern ourselves rather with the politics of education than with the thing itself.

RALPH, HOLLAND, AND CO.

A Short History of Education. By G. Benson Clough, Member of the late London and Brighton School Boards, etc. The writer has set himself the task of giving, in the space of 128 pages, a history of education ranging from China and India through Greece and Rome down to the twentieth century Board of Education, with a list of the great educational endowments of England in the Middle Ages, and a summary of the educational legislation of modern times. The task is, of course, an impossible one to perform with any thoroughness, and it has been as well done as the conditions of the problem permit. The most useful part, without doubt, is the summary referred to, which is likely to help in clearness of thinking on the present state of matters scholastic in our midst. A chronological table is appended, from 468 B.C. to 1903 A.D., arranged in the reverse to the usual order—a fact which does not aid its usefulness.

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THE SALVATION ARMY PUBLISHING COMPANY.

Training of Children; or, How to Make the Children into Saints and Soldiers of Jesus Christ. By the General of the Salvation Army. (Third Edition.) The most serious handicap upon this book is the language in which it is written, which is that of the Salvation Army. But it is worth the while of all educationists to read and translate into the less emotional phraseology of the majority of us. It is more directly addressed to parents than to teachers, for it deals chiefly with matters that fall within the sphere of the family, and its tendency is primarily religious. This, again, is wholesome; the responsibility of the parent, and the importance of a religious and moral training in the home, are perhaps more in need of being proclaimed aloud—and the General is an adept at such proclamation—than they were when our schools were in a more primitive condition.

SWAN SONNENSCHEIN AND CO.

The Secret of Herbart. An Essay on Education, and a Reply to Professor James of Harvard. By F. H. Hayward, D.Litt., M.A., B.Sc., author of *The Critics of Herbartianism*, etc. This book is a defence of the cardinal principle of Herbartianism, apperception, against some rather mild strictures of Professor James; but it is much more than this. The Harvard professor's remark is the occasion rather than the cause of the essay. The main purpose of the book may be most conveniently summed up in the writer's own words in the closing paragraph: "The last word shall be what was well-nigh the first word. Education, be it again said, has failed. The youths of our streets are mentally and morally little better than the oxen of our fields. But education, once more and finally be it said, has never yet had a chance. That chance, sooner or later, it is bound to have. In the belief of the writer it will come when man realises in all its depth and breadth the moral significance of the convictions here named *The Secret of Herbart*."

From this it will be gathered that the writer defends the thesis that the only hope of moral regeneration for the great mass of our people lies in education, for religion has already proved a failure; and that education is summed up in apperception—in the nourishing of the mind with noble ideas, and the creation of such interests as shall make life a worthy thing, and not leave our young people the easy prey of vice from the mere emptiness of their minds. The thesis is a great one, and is advocated with a lofty earnestness of purpose, and with a full knowledge of the state of education and of morals in at least part of the land. The purpose and the execution of the work are both so good that one feels reluctant to offer any criticism upon it; but this is not what the author desires. "It may be 'suggestive' and 'stimulating,' and all the rest; the writer wishes to know whether it is true," he says in the preface. Although we cannot claim to be one of the "few men in England capable of answering the question with authority," still as an educationist in a modest way, and more especially as a believer in Herbart according to our lights, we offer a word of the criticism desiderated.

The thesis advanced is *true*—as true as a fragment of truth can ever be, and yet full of danger to truth, as a fragment of truth always is when mistaken for the complete truth. That education which is to be the salvation of the people must be something wider than mere apperception. As a thoroughgoing Herbartian, Dr. Hayward abolishes the freedom of the will, at least to the extent of nine-tenths of conduct; as an educational expositor, he omits everything connected with the body. It is difficult to be enthusiastic over the education of a being who has neither body nor soul (or only one-tenth of a soul conceded for the sake of the argument), and who is simply a disembodied intellect. We should like to recommend two thoughts to the writer for further consideration, for they cannot be new to him. The first is that one need not deny freedom because it cannot be reconciled with the fact of causation, especially if the former be not only a fact of equal validity with the latter, but also a necessary postulate of much else that is true. Nothing ultimate can be "explained;" but although the puppy cannot catch his own tail, however rapidly he may gyrate, he knows it is *there*, even while standing still. The other thought is that education is the developing of a *man* and not of a monad; and however much transcendental theory may help the philosopher towards clearness in his conception of education as a process, he must descend to the phenomenal sphere if he is to inspire with enthusiasm those who live there all the time, and who may have the prejudice of thinking the body as real as the mind.

The writer seems to hint a suspicion that his views as expressed in the book are transitional. We think so; indeed we hope so—not that we would have any of them thrown overboard by him, but because we feel that with his enthusiasm and clear insight only a little more breadth is needed to enable him to wage still more effective warfare against ignorance and all its hosts of attendant evils.

CHARLES AND DIBLE.

Model Answers in Biology—Plant Life. By F. H. Shoosmith, B.Sc. So long as the present system of examination continues, by which the studies of two or three years are summarily tested by the written work of as many hours, so long will handbooks like the present be useful, and even necessary. A "model answer" ought to contain the maximum of pertinent information in the minimum of space, and even the youngest of examiners cannot but feel grateful for the desire to spare his valuable time. The questions and answers in this little handbook of some sixty pages cover in logical sequence the whole field of plant life embraced in the Scholarship and Certificate Examinations, and botany students will find them very useful for testing and revising their knowledge gained from systematic text-books. As was to be expected in "model answers," drawings accompany these in each case; but in actual practice students would be well advised to enlarge their sketches, especially those dealing with the more minute vegetable tissues. The drawings are all of the familiar blackboard type, and thus lend themselves to reproduction in classes where plant life enters into the scheme of nature study.

GINN AND CO.

Elementary Plane Geometry. Baker. Yet another attempt to lead up to the deductive study of geometry through a practical inductive course. The plan of the book is ably set out by the author, whose object is to make the classroom in geometry a sort of workshop, and who provides about a year's work for beginners.

Loci Critici. By G. Saintsbury, M.A., LL.D. Any one who is taking up the study of English language and literature at all seriously will find the perusal of this book extremely interesting and profitable. It consists of a collection of passages, most of them of considerable length, in which great writers have set forth their opinions of the standards by which literary works should be judged. Not only are English critical writers included, but the views of writers in other languages, ancient and modern, are set before the reader in careful translations.

MACMILLAN AND CO.

A Junior Geometry. By Barnard and Child. This is an abridgment and an adaptation of the *New Geometry for Schools* by the same authors, so favourably noticed in these columns some time ago. It contains all that is required for the preliminary university examinations, and is certain to hold its own among the many recent publications on geometry.

Theoretical Geometry for Beginners. Part III. Allcock. The contents of this part bring the work practically to the end of Book IV. There are in addition a number of miscellaneous problems, together with some practical applications. The large number of exercises on the various propositions should prove very serviceable.

HORACE MARSHALL AND SON.

Botany Rambles. Part I.—In the Spring. This is a capital little book, and is well calculated to lead children and others to study nature directly. In this respect it differs from many recent "nature study" books, which seem intended to supplant the book of nature rather than to explain it. True to his ideal the writer says: "If you have not time to read this little book and go out as well, then don't read it, but go out instead."

FOR STUDENT OR TOURIST.—Messrs. George Bell and Sons have just issued a clearly-printed abridgment of Gasc's well-known French Dictionary. Part I. consists of the French-English portion only, and in this form is specially suited to the needs of students reading French text and of travellers. Although the dictionary is an abridgment of the larger work, it retains the main features of that work—namely, fullness of important matter combined with condensation and conciseness, as well as strict accuracy in the renderings. The matter is arranged in three columns to the page, and very clearly printed in good black readable type. In addition there are several useful appendices dealing with proper names of personages; geographical proper names; irregular verbs in tabular form; tables of money, weights, and measures reduced to English equivalents, as well as several pages of useful notes on peculiarities of pronunciation and of the language generally. The book contains upwards of four hundred pages, is six by five inches in size, about an inch in thickness, and can therefore be easily slipped into the satchel, pocket, or travelling bag. This reliable and thoroughly serviceable dictionary deserves a wide circulation in its new and revised form.

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